2029C

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
SEATTLE, WASHINGTON 98101

APPLICATION OF:	)	
	)	
ARCO Alaska, Inc.	)	No. PSD-X81-13
P.O. Box 360	)	APPROVAL OF APPLICATION
Anchorage, Alaska 99510	)	TO CONSTRUCT
AND	)	
SOHIO Alaska Petroleum Co.	)	
Pouch 6-612	)	
Anchorage, Alaska 99502	)	
	)	

Pursuant to the Agency regulations for the Prevention of Significant Deterioration of Air Quality (PSD) set forth at Title 40, Code of the Federal Regulations, Part 52 and based upon the complete application submitted on April 2, 1981 by ARCO Alaska, Inc. and the SOHIO Alaska Petroleum Company, the Regional Administrator now finds as follows:

FINDINGS

1. ARCO Alaska, Inc. and the SOHIO Alaska Petroleum Company (hereafter referred to as ARCO/SOHIO) propose to install additional gas-fired turbines and heaters in the oil field at Prudhoe Bay, Alaska.

2. An analysis of projected emissions indicates that this project has the potential to emit more than the EPA significance levels for nitrogen oxides (NO_x), particulate matter (PM), carbon monoxide (CO) and sulfur dioxide (SO_2) and is therefore subject to PSD review for those pollutants.

3. The proposed modification is located in an area designated as "Class II" under Section 162(b) of the Clean Air Act.

4. Modeling analysis of CO, NO_x, SO_2 and PM has been conducted and demonstrates that while emissions of these pollutants will increase, the modification will not cause any violations of the applicable National Ambient Air Quality Standards or PSD increments so long as the facility is operated in accordance with the conditions specified below. With the application of best available control technology, as required by Section 165 (a)(4), operation of the proposed turbines and heaters will meet the applicable PSD requirements.

Accordingly, it is hereby determined that, subject to the conditions set forth below, ARCO Alaska, Inc. and the SOHIO Alaska Petroleum Company will be permitted to install the subject turbines and heaters at Prudhoe Bay, Alaska.

APPROVAL CONDITIONS

1. Emissions of nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), and sulfur dioxide (SO_2) shall not exceed the following:

EMISSION LIMITATIONS

Equipment	Pollutant	Tons/Year	Performance Limit
Gas Turbines	NO_x	8,217	150 (14.4/Y)ppm*
	CO	1,460	109 lb/10^6 scf of fuel used
	PM	198	10% opacity
	SO_2	48	
Process Heaters	CO	21	0.018 lb/10^6 BTU
	PM	12	
	SO_2	4	
> 43x10^6 BTU/hr	NO_x	88	0.08 lb/10^6 BTU
< 43x10^6 BTU/hr	NO_x		0.10 lb/10^6 BTU

*NO_x emission factor for gas-fired turbines is modified by an efficiency factor Y (manufacturer's rated heat rate at rated peak load) which cannot exceed 14.4 kilojoules/watt-hour based at 15% oxygen on a dry basis.

2. With the exception of NO_x, CO, PM, and SO_2 increases in

potential emissions of any pollutant regulated under the Clean Air Act resulting from this operation will be less than the significance levels.

3. ARCO/SOHIO shall notify Alaska Department of Environmental Conservation (ADEC) of any occurrence of any emissions in excess of limits specified in Condition Numbers 1 and 2 above; such notification shall be forwarded to ADEC in writing in a timely fashion and in each instance no later than ten (10) days from the date of such occurrence. The notification shall include an estimate of the resultant emissions and a narrative report of the cause, duration and steps taken to correct the problem and avoid a recurrence. ARCO/SOHIO shall contemporaneously send a copy of all such reports to EPA.

4. This approval shall become void if on-site construction is not commenced within eighteen (18) months after receipt of the approval or if on-site construction once initially commenced is discontinued for a period of eighteen (18) months.

5. As approved and conditioned by this permit any construction, modification or operation of the proposed facility shall be in accordance with the application which resulted in this permit. Nothing in this permit shall be construed to relieve ARCO Alaska, Inc. and the SOHIO Alaska Petroleum Company of its obligations under any State or Federal laws including Sections 303 and 114 of the Clean Air Act.

6. Compliance with emission limitations shall be demonstrated by source tests and a program of emission monitoring as described below:

a. Compliance Demonstration:

Compliance testing shall be conducted within 60 days after achieving the maximum production rate at which the turbines or process heaters will be operated but not later than 180 days

after startup of the specific emission source. The NSPS testing requirements for NO_x from gas turbines (40 CFR 60.335) shall be followed for each turbine. The company may submit for EPA approval an alternative test plan for the gas turbines addressing such alternatives as factory testing rather than on-site testing and testing of a certain proportion of the gas turbines for each model group rather than each individual gas turbine. EPA Method 7 shall be used for NO_x from the process heaters. Only one of each kind of process heater must be tested. The company shall submit a test plan to EPA for approval to demonstrate that the heater tested is representative of the heaters for which testing is exempted. No compliance testing is required for CO.

b. Emission Monitoring:

In addition to the NSPS requirements (40 CFR 60.334) one of the following monitoring schemes is required: (a) a continuous monitoring system shall be installed to monitor CO or O_2 for all gas-fired process heaters with a capacity greater than 43×10^6 BTU/hr. These monitors shall comply with the specification requirements in Appendix B of 40 CFR Part 60; or (b) a periodic monitoring program for the process heaters with a capacity greater than 43×10^6 BTU/hr using a portable CO or O_2 analyzer.

The company shall submit a monitoring plan to EPA for approval describing the details of the program such as monitoring frequency, proposed instrumentation, and quality assurance procedures. Monitoring records shall be available to EPA upon request and shall be maintained for a period of two years.

7. EPA Regional Office and ADEC shall be notified of the commencement of construction and the start up date within thirty (30) days of the date of their occurrence.

Access to the source by EPA or State regulatory personnel will be permitted upon request for the purpose of compliance assurance inspections. Failure to allow such access is grounds for revocation of this permit.

SEP 29 1981

Date

John R. Spencer
Regional Administrator

2023C (1)
Prud

M/S 521

SEP 29 1981

Mr. Stan Hungerford
Air Pollution Control Agency
State of Alaska
Dept. of Environmental Conservation
Pouch O
Juneau, Alaska 99811

Dear Mr. Hungerford:

EPA, Region 10, has made a final determination on the ARCO Alaska Inc. and SOHIO Alaska Petroleum Company's (ARCO/SOHIO) proposal to install additional gas-fired turbines and heaters at the Prudhoe Bay oil field complex at Prudhoe Bay, Alaska.

Enclosed are copies of the PSD permit, final determination document and letter of approval to ARCO/SOHIO to be added to the existing public review package and made available to the public for an additional sixty (60) days. The package can be destroyed at the end of the review period.

Thank you for your cooperation in this matter.

Sincerely,

Michael M. Johnston, Chief
New Source Permits Section

Enclosures

RNYE:jb:8-24-81(#1367N)

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PS Form 3811, Jan. 1979

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   G. N. Nelson (SOHIO)
   Pouch 6-612
   Anchorage, AK 99502

3. **ARTICLE DESCRIPTION:**

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	3403921	

(Always obtain signature of addressee or agent)

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4. Jeanne Jones

DATE OF DELIVERY 10-2-81

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PSDIV - ARCO/SOHIO

☆GPO : 1979-288-848

P15 3403921

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SENT TO
G.N. Nelson (SOHIO)

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Pouch 6-612

P.O., STATE AND ZIP CODE
Anchorage, AK 99502

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PS Form 3800, Apr. 1976

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2. If you do not want this receipt postmarked, stick the gummed stub on the left portion of the address side of the article, date, detach and retain the receipt, and mail the article.
3. If you want a return receipt, write the certified-mail number and your name and address on a return receipt card, Form 3811, and attach it to the front of the article by means of the gummed ends if space permits. Otherwise, affix to back of article. Endorse front of article **RETURN RECEIPT REQUESTED** adjacent to the number.
4. If you want delivery restricted to the addressee, or to an authorized agent of the addressee, endorse RESTRICTED DELIVERY on the front of the article.
5. Enter fees for the services requested in the appropriate spaces on the front of this receipt. If return receipt is requested, check the applicable blocks in Item 1 of Form 3811.
6. Save this receipt and present it if you make inquiry.

☆ GPO : 1979 O - 289-363

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

2025C

M/S 521

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

SEP 29 1981

Mr. G. N. Nelson
SOHIO Alaska Petroleum Company
Pouch 6-612
Anchorage, Alaska 99502

Dear Mr. Nelson:

We have evaluated your application for a Prevention of Significant Deterioration (PSD) permit to install additional gas-fired turbines and heaters at the Prudhoe Bay oil field and have determined that the project will meet the requirements of the PSD permit regulations and the Clean Air Act. Accordingly, on the basis of the complete PSD permit application, submitted on April 2, 1981, EPA hereby grants its approval to ARCO Alaska, Inc. and the SOHIO Alaska Petroleum Company to modify the existing Prudhoe Bay facilities subject to the terms and conditions contained in the enclosed permit. Also enclosed is EPA's Final Determination Analysis Document for this project.

As established in the Consolidated Permit Regulations, codified at 40 CFR Part 124, this permit will become effective 30 days from your receipt of this letter unless review is requested under § 124.19. Once it has become effective, the final permit decision will be final agency action and will be published in the Federal Register. If a petition for review under § 124.19 has been filed this final action may be challenged by filing a petition for judicial review in the United States Court of Appeals for the appropriate circuit within 60 days of the date of the Federal Register notice.

Sincerely,

/s/sJohn R. Spencer

John R. Spencer
Regional Administrator

Enclosures

cc: P. B. Norgaard, ARCO
D. F. Diaz, SOHIO
W. P. Metz, ARCO

CONCURRENCES

SYMBOL	RNYE						
SJRNAME	RNYE:jb:9-16-81(#1393N)						
DATE	8/24/81	9/21/81	9/22	9/22/81			

EPA Form 1320-1 (12-70) OFFICIAL FILE COPY

NYE JOHNSTON GEREN REED COATE

P15 3403920

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Norgaard (ARCO)

STREET AND NO.
P.O. Box 360

P.O., STATE AND ZIP CODE
Anchorage AK 99510

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6. Save this receipt and present it if you make inquiry.

☆ GPO : 1979 O - 289-363

PS Form 3811, Jan. 1979

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2. ARTICLE ADDRESSED TO:
P.B. Norgaard
ARCO Alaska, Inc
P.O. Box 360
Anchorage AK 99510

3. ARTICLE DESCRIPTION:

REGISTERED NO.	CERTIFIED NO.	INSURED NO.
	3403920	

(Always obtain signature of addressee or agent)

I have received the article described above.
SIGNATURE ☐ Addressee ☑ Authorized agent

4. DATE OF DELIVERY

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PSD IV - ARCO/SOHIO

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1200 SIXTH AVENUE
SEATTLE, WA 98101-3188

(Street or P.O. Box)

(City, State, and ZIP Code)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

M/S 521

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

SEP 29 1981

Mr. P. B. Norgaard
ARCO Alaska, Inc.
P. O. Box 360
Anchorage, Alaska 99570

Dear Mr. Norgaard:

We have evaluated your application for a Prevention of Significant Deterioration (PSD) permit to install additional gas-fired turbines and heaters at the Prudhoe Bay oil field and have determined that the project will meet the requirements of the PSD permit regulations and the Clean Air Act. Accordingly, on the basis of the complete PSD permit application, submitted on April 2, 1981, EPA hereby grants its approval to ARCO Alaska, Inc. and the SOHIO Alaska Petroleum Company to modify the existing Prudhoe Bay facilities subject to the terms and conditions contained in the enclosed permit. Also enclosed is EPA's Final Determination Analysis Document for this project.

As established in the Consolidated Permit Regulations, codified at 40 CFR Part 124, this permit will become effective 30 days from your receipt of this letter unless review is requested under § 124.19. Once it has become effective, the final permit decision will be final agency action and will be published in the Federal Register. If a petition for review under § 124.19 has been filed this final action may be challenged by filing a petition for judicial review in the United States Court of Appeals for the appropriate circuit within 60 days of the date of the Federal Register notice.

Sincerely,

/s/sJohn R. Spencer

John R. Spencer
Regional Administrator

Enclosures

CONCURRENCES

SYMBOL	cc: G. N. Nelson, SOHIO					
SURNAME	D. F. Diaz, SOHIO					
DATE	W. P. Metz, ARCO RNYE:jb:9-16-81(#1393N)		9/22/81			

EPA Form 1320-1 (12-70) ADAMS NYE JOHNSTON GEREN REED COATE OFFICIAL FILE COPY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

2026C
Print

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 10
SEATTLE, WASHINGTON 98101

NOTICE OF ISSUANCE OF PSD PERMIT TO
ARCO ALASKA, INC. AND SOHIO ALASKA PETROLEUM COMPANY

Notice is hereby given that on September 29, 1981, the Environmental Protection Agency (EPA) issued a Prevention of Significant Deterioration (PSD) permit to Arco Alaska, Inc. and Sohio Alaska Petroleum Company for approval to install additional gas-fired turbines and heaters in the oil field at Prudhoe Bay, Alaska.

This permit has been issued under EPA's Prevention of Significant Air Quality Deterioration (40 CFR Part 52.21) regulations, subject to certain conditions specified in the permit.

Under Section 307(b)(1) of the Clean Air Act, judicial review of the PSD Permit is available only by the filing of a petition for review in the Ninth Circuit Court of Appeals within 60 days of today. Under Section 307(b)(2) of the Clean Air Act, the requirements which are the subject of today's notice may not be challenged later in civil or criminal proceedings brought by EPA to enforce these requirements.

Copies of the permit are available for public inspection upon request at the following location:

EPA, Region 10
1200 Sixth Avenue, Room 11C, M/S 521
Seattle, Washington 98101

27 OCT 1981
Date

/s/sJohn R. Spencer
John R. Spencer
Regional Administrator

CONCURRENCES

SYMBOL								
	REN		RMP	AS				
SURNAME	NYE	JOHNSTON	POSS	SMITH	COATE	SPENCER		
DATE	10/9/81	10/9/81	10/15/81	10/16/81				

EPA Form 1320-1 (12-70) OFFICIAL FILE COPY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: SEP 22 1981

SUBJECT: ACTION MEMORANDUM - Final PSD Approval of Construction for the ARCO Alaska, Inc. and SOHIO Alaska Petroleum Company (ARCO/SOHIO) at Prudhoe Bay, Alaska

FROM: Lloyd A. Reed, Director
Enforcement Division (M/S 517)

TO: John R. Spencer
Regional Administrator (M/S 601)

Background

On April 2, 1981, EPA received a complete PSD application from ARCO/SOHIO requesting approval to install additional gas fired turbines and heaters in the Prudhoe Bay oil field at Prudhoe Bay, Alaska. After an initial review of the application, a preliminary determination that the proposed modification appeared approvable was issued on July 16, 1981 and circulated for public comment. The public participation requirements outlined in the PSD regulations have been satisfied.

Public Comment

EPA received letters from the applicant, General Electric Company, and the Alaska Department of Environmental Conservation objecting to the best available control technology determination for nitrogen oxides emissions from gas turbines. Our response to those comments is addressed in the Final Determination document.

Recommendation

Since the requirements of the PSD regulations are fulfilled, it is recommended that you sign the PSD permit and the letters to Mr. Nelson and Mr. Norgaard granting approval to install the subject turbines and heaters.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SEP 22 1981

ACTION MEMORANDUM - Final PSD Approval of Construction for the ARCO Alaska, Inc. and SOHIO Alaska Petroleum Company (ARCO/SOHIO) at Prudhoe Bay, Alaska

Lloyd A. Reed, Director /s/ Lloyd A. Reed
Enforcement Division (M/S 517)

John R. Spencer
Regional Administrator (M/S 601)

Background

On April 2, 1981, EPA received a complete PSD application from ARCO/SOHIO requesting approval to install additional gas fired turbines and heaters in the Prudhoe Bay oil field at Prudhoe Bay, Alaska. After an initial review of the application, a preliminary determination that the proposed modification appeared approvable was issued on July 16, 1981 and circulated for public comment. The public participation requirements outlined in the PSD regulations have been satisfied.

Public Comment

EPA received letters from the applicant, General Electric Company, and the Alaska Department of Environmental Conservation objecting to the best available control technology determination for nitrogen oxides emissions from gas turbines. Our response to those comments is addressed in the Final Determination document.

Recommendation

Since the requirements of the PSD regulations are fulfilled, it is recommended that you sign the PSD permit and the letters to Mr. Nelson and Mr. Norgaard granting approval to install the subject turbines and heaters.

Janice

	CADAMS:b1:8-21-81:(1358N)	CONCURRENCES					
SYMBOL	RCN		9/22				
SURNAME	NYE	JOHNSTON	GEREN				
DATE	9-16-81	9/21/81	9/22				

EPA Form 1320-1 (12-70) OFFICIAL FILE COPY

FINAL DETERMINATION ANALYSIS DOCUMENT
PREVENTION OF SIGNIFICANT DETERIORATION
AND
APPROVAL OF CONSTRUCTION
ARCO ALASKA, INC. / SOHIO ALASKA PETROLEUM COMPANY
PRUDHOE BAY, ALASKA

SCOPE

This document presents the final determination by the Environmental Protection Agency (EPA) to approve the construction of additional gas-fired turbines and heaters at the Prudhoe Bay oil field complex at Prudhoe Bay, Alaska under the Federal requirements of Part C, Title 1, of the Clean Air Act; Prevention of Significant Deterioration of Air Quality (PSD).

BACKGROUND

On April 2, 1981, EPA Region 10 received from ARCO Alaska Inc. and SOHIO Alaska Petroleum Company (ARCO/SOHIO) a complete PSD permit application requesting approval for the installation of additional gas-fired turbines and heaters at the Prudhoe Bay oil field. EPA reviewed this material and presented its findings in a preliminary determination document which was released for public comment and published in the Fairbanks "News-Miner" on July 8, 1981 and the Anchorage "Times" on July 16, 1981. A preliminary determination to approve the facility was issued on the basis that the National Ambient Air Quality Standards (NAAQS) and PSD increments would not be exceeded and the best available control technology (BACT) would be employed. Affected governmental agencies and the general public were notified of their opportunity to submit written comments and request a public hearing regarding EPA's preliminary determination.

PUBLIC COMMENT

EPA received written comments from the applicant, the General Electric Company and the Alaska Department of Environmental Conservation.

1. Comment

The commentors all objected to the proposed 100 ppm nitrogen oxide emission limitation for the gas-fired turbines. The applicant and the Alaska Department of Environmental Conservation (ADEC) contend that (1) turbine manufacturers do not guarantee the reduction of NO_x emissions to the level suggested to be BACT in EPA's technical analyses and that (2) it was unreasonable to extrapolate maximum limits for all turbine sizes based on the source test data base used by EPA, which was too limited.

The General Electric Company's (GEC) objection to the NO_x emissions limitation was that the BACT determination was more

stringent than the New Source Performance Standards (NSPS) for gas-fired turbines. The GEC letter states that a BACT limitation for NO_x emissions from gas-fired turbines lower than NSPS "appears to contradict directly," the New Source Performance Standards.

EPA RESPONSE

The EPA technical staff considered these comments and agreed to increase the BACT limitation from 100 ppm to 150 ppm for the NO_x pollutant. Since very few turbines are currently guaranteed to meet the proposed emissions limitation, EPA conceded that the proposed BACT limitation would not allow ARCO/SOHIO engineers sufficient flexibility in the selection of various turbine models. It was also concluded that this limitation would unduly restrict competition among manufacturer's of larger, fuel efficient turbines.

Five sources tests on gas-fired turbines in the area all showed results for NO_x emissions of less than 100 ppm on varying turbine models and sizes. These results indicated that the proposed BACT limitation was achievable, thus providing both environmental benefits and the desirability of reserving PSD increment to allow future expansion in the area. While the source test results provided evidence supporting the proposed BACT level, EPA acknowledges that given the small data base and allowances which must be made for variations in testing and operating parameters, the source test data does not support finalizing the proposed BACT limitation in light of the objections from the applicant and the State.

It appears that the clarification of BACT and NSPS is needed with respect to the comment comparing BACT and NSPS. BACT, as opposed to NSPS, is determined on a case-by-case basis for each permit application. The objective of BACT is to reach the maximum degree of emission reduction possible taking into account energy, economic, and environmental impacts unique to that project. The primary purpose of BACT is to minimize consumption of PSD air quality increments, thereby maximizing the potential for future growth. BACT's case-by-case approach allows improvements in emission control technology to be put to practical use more quickly than would occur through uniform application of NSPS. NSPS limits are often determined to be BACT although some sources are capable of lower emissions. NSPS is the starting point for BACT. BACT can be more strigent, but never less stringent than NSPS.

2. Comment

The applicant and ADEC objected to the use of the Industrial Source Complex (ISC) model because it is not yet listed in the Guideline on Air Quality Models (EPA-450/2-78-027). ADEC cited EPA

regulations on modification and substitutions of guideline models, suggesting that the responsibility for model selection, under those circumstances, belongs to the applicant. The applicant had originally proposed to use the Texas Climatological Model (TCM). However, EPA required the ISC model because it is the most suitable model available for calculating building-induced-downwash of pollutants, a potential problem at this source. The applicant objected to the use of the ISC model, but agreed to use the model to avoid potential costs associated with project delays.

EPA RESPONSE

The regulation cited by the State was 40 CFR 52.21(m)(2). Under the revised regulations dated August 7, 1980 that section is now numbered 40 CFR 52.21(1)(2) and states, "Where an air quality impact model specified in the 'Guideline on Air Quality Models' is inappropriate, the model may be modified or another model substituted. Such a change must be subject to notice and opportunity for public comment... Written approval of the Administrator must be obtained for any modification or substitution."

The preliminary determination discussed in detail the use of the non-guideline model. The public was notified of its use in the public notice and of their opportunity to comment on this particular application of the model. The use of a non-guideline model is a process integral to the processing of a PSD permit application, a process that has been delegated to the appropriate regional administrators since the inception of the PSD program.

The rationale for selection of the ISC model was thoroughly explained in the technical analysis document. Briefly, the reason why EPA required it for this project is that building-induced downwash of pollutants is expected to be a problem because of the use of short exhaust stacks and the flat terrain in the area. The ISC model has been evaluated in a study titled, "An Evaluation Study for the Industrial Source Complex (ISC) Dispersion Model", EPA-450/4-81-002, January 1981.

3. Comment

ADEC stated that no comparison between the fundamental and optional algorithms of the ISC model and those of an approved model was presented in the application.

EPA Response

The ISC model was compared with the CRSTER model (an approved EPA model) in the technical analysis document. This comparison was based on the study, "An Evaluation Study for the Industrial Source Complex (ISC) Dispersion Model", EPA-450/4-81-002, January 1981.

The results of this study showed that the building-wake effects option of the ISC model significantly improves the performance of the ISC model over that of the corresponding models (CRSTER and MPTER).

4. Comment

ADEC objected to the utilization of the building-wake effects option of the ISC model 100% of the time in predicting annual ambient exposures and suggests the model would be more applicable for ambient impact exposure times of 24 hours or less, or for identifying physical locations where pollutant concentrations are higher due to the building-wake effect.

EPA Response

The inclusion of the building-wake effects option in the ISC model does not mean that the model will calculate downwash 100% of the time. The ISC model will only calculate downwash when plume rise and meteorological conditions indicate that downwash is likely to occur. The criteria which determine when and where downwash is calculated by the model are explained in detail in the Industrial Source Complex (ISC) Dispersion Model User's Guide, EPA-450/4-70-030, December 1979.

5. Comment

ARCO/SOHIO agreed with EPA's technical analysis that the installation of low NO_x burners constitutes state-of-the art control technology, but requested that the emission limitation for the use of low NO_x burners be increased to 0.10 $lb/10^6$ BTU, in lieu of the recommended 0.08 $lb/10^6$ BTU. ADEC requested that source test and monitoring data from existing facilities be cited to support the EPA recommended limitation. The applicant also suggested that process heaters less than 43 x 10^6 BTU be limited to 0.19 $lb/10^6$ BTU.

EPA Response

The EPA technical staff rechecked references and calculations for the proposed NO_x limit of 0.08 $lb/10^6$ BTU and found no reason to relax this limitation. Two draft reports based on source test data from refinery and petroleum process heaters support EPA's determination: (1) Tidona, R.J., "Emissions from Refinery Process Heaters Equipped with low NO_x Burners", and (2) Carter W.A. & Tidona, R.J., "Reduction by Combustion Modification for Petroleum Process Heaters".

With respect to the comment about the smaller process heaters, without more specific design characteristics, an emission limitation

greater than the recommended value of 0.10 lb/10^6 BTU is not suggested. While space heaters that cannot safely operate at excess air rates less than 15% are given a NO_x limitation of 0.19 lb/10^6 BTU, EPA is assuming 4% excess oxygen for the heaters requested in the application and is confident that process heaters less than 43 x 10^6 BTU can meet the 0.10 lb/10^6 BTU NO_x limitation.

6. Comment

ADEC objected to the use of the term "existing sources" in defining existing air quality suggesting it was misleading.

EPA Response

The distinction is made, in the technical analysis, between existing sources, previously permitted sources, and proposed sources. The time period (April 1, 1979 to March 31, 1980) during which monitoring was conducted is also indicated. Existing sources in the monitoring study means the sources that were in operation at the time monitoring was conducted.

7. Comment

ADEC pointed out what appeared to be a discrepancy between the TSP values reported in Table 2 of the technical analysis document and the TSP values listed in the applicants report.

EPA Response

The maximum measured pollutant values in Table 2 were taken from Table III-7 of the Air Quality and Meteorological Monitoring Study at Prudhoe Bay, Alaska, Final Report, Radian Corporation, January 1981. The maximum TSP values in the applicant's report were the second highest TSP values measured in the Prudhoe Bay Monitoring Study. Use of the second highest 24-hour TSP values measured during one year, as done in the applicant's report, is more appropriate than using the maximum measured values for comparison with the 24-hour TSP National Ambient Air Quality Standards (NAAQS) since NAAQS are interpreted as "not to be exceeded more than once per year" (40 CFR 50.6).

8. Comment

ADEC suggested that Table 2 of the technical analysis presents too much information in one table for a person unfamiliar with the project to grasp.

EPA Response

The purpose of Table 2 was to compare the maximum measured pollutant values and the background pollutant values with the National Primary Ambient Air Quality Standards. Use of more than one table to accomplish this could also be confusing to the reader.

9. Comment

ADEC questioned why primary 24-hour TSP standards were listed in Table 2 and secondary 24-hour TSP standards were listed in Table 3 of the technical analysis. The agency contended that this inconsistency was confusing for readers not completely familiar with the standards.

EPA Response

The primary TSP standards were listed in Table 2 because the intent was to compare the maximum measured pollutant values with the primary standards. Primary standards define levels of air quality which the Administrator judges are necessary, with an adequate margin of safety, to protect the public health (40 CFR 50.2(b)). Secondary TSP standards were used in Table 3 to show that predicted air quality levels would not exceed the less restrictive secondary standards. Admittedly, the PSD regulations are quite complex. Given the varying degree of familiarity with the regulations among readers, not every term used in the technical evaluation is defined. However, copies of the regulations, which do include definitions of the terminology contained, are sent to the public inspection locations with the technical analysis for use by readers who might find them helpful.

10. Comment

ADEC suggested that the comparision between the maximum measured pollutant values and the National primary 24-hour TSP standard of 260 ug/m^3 in Table 2 was irrelevant because the Alaska 24-hour Ambient Air Quality Standard for TSP is 150 ug/m^3.

EPA Response

One of the major purposes of the EPA PSD air quality review is to demonstrate that no "National Ambient Air Quality Standards" would be violated by the proposed sources. EPA is limited by regulation to basing PSD permit decisions on the installation of BACT and project impacts on NAAQS and PSD increments. No where are we given the authority to base PSD permit decisions on the state standards. The state has full authority to insure that state standards are not violated.

11. Comment

ADEC suggested that the random grid distribution used in the modeling analysis might result in an underestimation of ground-level pollutant concentrations under some circumstances depending on how the source exhaust stacks are located.

EPA Response

The applicant used the random grid distribution in the air quality analysis for the sources because the location, number, and sizes of specific future modules is changing as the design process continues. For this reason, use of this grid system is probably the most appropriate approach to the spacing of sources in the air quality analysis. Use of this grid system should not significantly add to the uncertainty of the final modeling results.

12. Comment

ADEC stated that the comparison made between general NO_2 impacts listed in the PSD I application with general NO_2 impacts listed in the PSD IV applicaton is not valid because different models were used for each application.

EPA Response

EPA chose the ISC model for the NO_x impact analysis because it is the best model available for this particular source. Since PSD I is already permitted it would be pointless to rerun the impact analysis with the ISC model.

FINDINGS

Based upon our review of the application, EPA finds that the "Class II" air quality increments and the NAAQS will not be exceeded as a result of this project and that the proposed construction will employ BACT. In light of these findings, EPA grants approval to install the turbines and heaters requested by ARCO/SOHIO. This approval is subject to the terms and conditions set forth in the letter of approval to ARCO Alaska, Inc. and the SOHIO Alaska Petroleum Company.

ADRIN RNTE:jb:9-16-81(#1371N)

CONCURRENCES

SYMBOL								
SJRNAME	JOHNSTON	GEREN	REED	COATE	SPENCER			
DATE	9/21/81	9/22	9/22					

EPA Form 1320-1 (12-70)

OFFICIAL FILE COPY

FINAL DETERMINATION ANALYSIS DOCUMENT
PREVENTION OF SIGNIFICANT DETERIORATION
AND
APPROVAL OF CONSTRUCTION
ARCO ALASKA, INC. / SOHIO ALASKA PETROLEUM COMPANY
PRUDHOE BAY, ALASKA

SCOPE

This document presents the final determination by the Environmental Protection Agency (EPA) to approve the construction of additional gas-fired turbines and heaters at the Prudhoe Bay oil field complex at Prudhoe Bay, Alaska under the Federal requirements of Part C, Title 1, of the Clean Air Act; Prevention of Significant Deterioration of Air Quality (PSD).

BACKGROUND

On April 2, 1981, EPA Region 10 received from ARCO Alaska Inc. and SOHIO Alaska Petroleum Company (ARCO/SOHIO) a complete PSD permit application requesting approval for the installation of additional gas-fired turbines and heaters at the Prudhoe Bay oil field. EPA reviewed this material and presented its findings in a preliminary determination document which was released for public comment and published in the Fairbanks "News-Miner" on July 8, 1981 and the Anchorage "Times" on July 16, 1981. A preliminary determination to approve the facility was issued on the basis that the National Ambient Air Quality Standards (NAAQS) and PSD increments would not be exceeded and the best available control technology (BACT) would be employed. Affected governmental agencies and the general public were notified of their opportunity to submit written comments and request a public hearing regarding EPA's preliminary determination.

PUBLIC COMMENT

EPA received written comments from the applicant, the General Electric Company and the Alaska Department of Environmental Conservation.

1. Comment

The commentors all objected to the proposed 100 ppm nitrogen oxide emission limitation for the gas-fired turbines. The applicant and the Alaska Department of Environmental Conservation (ADEC) contend that (1) turbine manufacturers do not guarantee the reduction of NO_x emissions to the level suggested to be BACT in EPA's technical analyses and that (2) it was unreasonable to extrapolate maximum limits for all turbine sizes based on the source test data base used by EPA, which was too limited.

The General Electric Company's (GEC) objection to the NO_x emissions limitation was that the BACT determination was more

stringent than the New Source Performance Standards (NSPS) for gas-fired turbines. The GEC letter states that a BACT limitation for NO_x emissions from gas-fired turbines lower than NSPS "appears to contradict directly," the New Source Performance Standards.

EPA RESPONSE

The EPA technical staff considered these comments and agreed to increase the BACT limitation from 100 ppm to 150 ppm for the NO_x pollutant. Since very few turbines are currently guaranteed to meet the proposed emissions limitation, EPA conceded that the proposed BACT limitation would not allow ARCO/SOHIO engineers sufficient flexibility in the selection of various turbine models. It was also concluded that this limitation would unduly restrict competition among manufacturer s of larger, fuel efficient turbines.

Five source tests on gas-fired turbines in the area all showed results for NO_x emissions of less than 100 ppm on varying turbine models and sizes. These results indicated that the proposed BACT limitation was achievable, thus providing both environmental benefits and the desirability of reserving PSD increment to allow future expansion in the area. While the source test results provided evidence supporting the proposed BACT level, EPA acknowledges that given the small data base and allowances which must be made for variations in testing and operating parameters, the source test data does not support finalizing the proposed BACT limitation in light of the objections from the applicant and the State.

It appears that the clarification of BACT and NSPS is needed with respect to the comment comparing BACT and NSPS. BACT, as opposed to NSPS, is determined on a case-by-case basis for each permit application. The objective of BACT is to reach the maximum degree of emission reduction possible taking into account energy, economic, and environmental impacts unique to that project. The primary purpose of BACT is to minimize consumption of PSD air quality increments, thereby maximizing the potential for future growth. BACT's case-by-case approach allows improvements in emission control technology to be put to practical use more quickly than would occur through uniform application of NSPS. NSPS limits are often determined to be BACT although some sources are capable of lower emissions. NSPS is the starting point for BACT. BACT can be more strigent, but never less stringent than NSPS.

2. Comment

The applicant and ADEC objected to the use of the Industrial Source Complex (ISC) model because it is not yet listed in the Guideline on Air Quality Models (EPA-450/2-78-027). ADEC cited EPA

regulations on modification and substitutions of guideline models, suggesting that the responsibility for model selection, under those circumstances, belongs to the applicant. The applicant had originally proposed to use the Texas Climatological Model (TCM). However, EPA required the ISC model because it is the most suitable model available for calculating building-induced-downwash of pollutants, a potential problem at this source. The applicant objected to the use of the ISC model, but agreed to use the model to avoid potential costs associated with project delays.

EPA RESPONSE

The regulation cited by the State was 40 CFR 52.21(m)(2). Under the revised regulations dated August 7, 1980 that section is now numbered 40 CFR 52.21(l)(2) and states, "Where an air quality impact model specified in the 'Guideline on Air Quality Models' is inappropriate, the model may be modified or another model substituted. Such a change must be subject to notice and opportunity for public comment... Written approval of the Administrator must be obtained for any modification or substitution."

The preliminary determination discussed in detail the use of the non-guideline model. The public was notified of its use in the public notice and of their opportunity to comment on this particular application of the model. The use of a non-guideline model is a process integral to the processing of a PSD permit application, a process that has been delegated to the appropriate regional administrators since the inception of the PSD program.

The rationale for selection of the ISC model was thoroughly explained in the technical analysis document. Briefly, the reason why EPA required it for this project is that building-induced downwash of pollutants is expected to be a problem because of the use of short exhaust stacks and the flat terrain in the area. The ISC model has been evaluated in a study titled, "An Evaluation Study for the Industrial Source Complex (ISC) Dispersion Model", EPA-450/4-81-002, January 1981.

3. Comment

ADEC stated that no comparison between the fundamental and optional algorithms of the ISC model and those of an approved model was presented in the application.

EPA Response

The ISC model was compared with the CRSTER model (an approved EPA model) in the technical analysis document. This comparison was based on the study, "An Evaluation Study for the Industrial Source Complex (ISC) Dispersion Model", EPA-450/4-81-002, January 1981.

The results of this study showed that the building-wake effects option of the ISC model significantly improves the performance of the ISC model over that of the corresponding models (CRSTER and MPTER).

4. Comment

ADEC objected to the utilization of the building-wake effects option of the ISC model 100% of the time in predicting annual ambient exposures and suggests the model would be more applicable for ambient impact exposure times of 24 hours or less, or for identifying physical locations where pollutant concentrations are higher due to the building-wake effect.

EPA Response

The inclusion of the building-wake effects option in the ISC model does not mean that the model will calculate downwash 100% of the time. The ISC model will only calculate downwash when plume rise and meteorological conditions indicate that downwash is likely to occur. The criteria which determine when and where downwash is calculated by the model are explained in detail in the Industrial Source Complex (ISC) Dispersion Model User's Guide, EPA-450/4-70-030, December 1979.

5. Comment

ARCO/SOHIO agreed with EPA's technical analysis that the installation of low NO_x burners constitutes state-of-the art control technology, but requested that the emission limitation for the use of low NO_x burners be increased to 0.10 lb/10^6 BTU, in lieu of the recommended 0.08 lb/10^6 BTU. ADEC requested that source test and monitoring data from existing facilities be cited to support the EPA recommended limitation. The applicant also suggested that process heaters less than 43 x 10^6 BTU be limited to 0.19 lb/10^6 BTU.

EPA Response

The EPA technical staff rechecked references and calculations for the proposed NO_x limit of 0.08 lb/10^6 BTU and found no reason to relax this limitation. Two draft reports based on source test data from refinery and petroleum process heaters support EPA's determination: (1) Tidona, R.J., "Emissions from Refinery Process Heaters Equipped with low NO_x Burners", and (2) Carter W.A. & Tidona, R.J., "Reduction by Combustion Modification for Petroleum Process Heaters".

With respect to the comment about the smaller process heaters, without more specific design characteristics, an emission limitation

greater than the recommended value of 0.10 lb/10^6 BTU is not suggested. While space heaters that cannot safely operate at excess air rates less than 15% are given a NO_x limitation of 0.19 lb/10^6 BTU, EPA is assuming 4% excess oxygen for the heaters requested in the application and is confident that process heaters less than 43 x 10^6 BTU can meet the 0.10 lb/10^6 BTU NO_x limitation.

6. Comment

ADEC objected to the use of the term "existing sources" in defining existing air quality suggesting it was misleading.

EPA Response

The distinction is made, in the technical analysis, between existing sources, previously permitted sources, and proposed sources. The time period (April 1, 1979 to March 31, 1980) during which monitoring was conducted is also indicated. Existing sources in the monitoring study means the sources that were in operation at the time monitoring was conducted.

7. Comment

ADEC pointed out what appeared to be a discrepancy between the TSP values reported in Table 2 of the technical analysis document and the TSP values listed in the applicants report.

EPA Response

The maximum measured pollutant values in Table 2 were taken from Table III-7 of the Air Quality and Meteorological Monitoring Study at Prudhoe Bay, Alaska, Final Report, Radian Corporation, January 1981. The maximum TSP values in the applicant's report were the second highest TSP values measured in the Prudhoe Bay Monitoring Study. Use of the second highest 24-hour TSP values measured during one year, as done in the applicant's report, is more appropriate than using the maximum measured values for comparison with the 24-hour TSP National Ambient Air Quality Standards (NAAQS) since NAAQS are interpreted as "not to be exceeded more than once per year" (40 CFR 50.6).

8. Comment

ADEC suggested that Table 2 of the technical analysis presents too much information in one table for a person unfamiliar with the project to grasp.

EPA Response

The purpose of Table 2 was to compare the maximum measured pollutant values and the background pollutant values with the National Primary Ambient Air Quality Standards. Use of more than one table to accomplish this could also be confusing to the reader.

9. Comment

ADEC questioned why primary 24-hour TSP standards were listed in Table 2 and secondary 24-hour TSP standards were listed in Table 3 of the technical analysis. The agency contended that this inconsistency was confusing for readers not completely familiar with the standards.

EPA Response

The primary TSP standards were listed in Table 2 because the intent was to compare the maximum measured pollutant values with the primary standards. Primary standards define levels of air quality which the Administrator judges are necessary, with an adequate margin of safety, to protect the public health (40 CFR 50.2(b)). Secondary TSP standards were used in Table 3 to show that predicted air quality levels would not exceed the less restrictive secondary standards. Admittedly, the PSD regulations are quite complex. Given the varying degree of familiarity with the regulations among readers, not every term used in the technical evaluation is defined. However, copies of the regulations, which do include definitions of the terminology contained, are sent to the public inspection locations with the technical analysis for use by readers who might find them helpful.

10. Comment

ADEC suggested that the comparision between the maximum measured pollutant values and the National primary 24-hour TSP standard of 260 ug/m^3 in Table 2 was irrelevant because the Alaska 24-hour Ambient Air Quality Standard for TSP is 150 ug/m^3.

EPA Response

One of the major purposes of the EPA PSD air quality review is to demonstrate that no "National Ambient Air Quality Standards" would be violated by the proposed sources. EPA is limited by regulation to basing PSD permit decisions on the installation of BACT and project impacts on NAAQS and PSD increments. Nowhere are we given the authority to base PSD permit decisions on the state standards. The state has full authority to insure that state standards are not violated.

11. Comment

ADEC suggested that the random grid distribution used in the modeling analysis might result in an underestimation of ground-level pollutant concentrations under some circumstances depending on how the source exhaust stacks are located.

EPA Response

The applicant used the random grid distribution in the air quality analysis for the sources because the location, number, and sizes of specific future modules is changing as the design process continues. For this reason, use of this grid system is probably the most appropriate approach to the spacing of sources in the air quality analysis. Use of this grid system should not significantly add to the uncertainty of the final modeling results.

12. Comment

ADEC stated that the comparison made between general NO_2 impacts listed in the PSD I application with general NO_2 impacts listed in the PSD IV applicaton is not valid because different models were used for each application.

EPA Response

EPA chose the ISC model for the NO_x impact analysis because it is the best model available for this particular source. Since PSD I is already permitted it would be pointless to rerun the impact analysis with the ISC model.

FINDINGS

Based upon our review of the application, EPA finds that the "Class II" air quality increments and the NAAQS will not be exceeded as a result of this project and that the proposed construction will employ BACT. In light of these findings, EPA grants approval to install the turbines and heaters requested by ARCO/SOHIO. This approval is subject to the terms and conditions set forth in the letter of approval to ARCO Alaska, Inc. and the SOHIO Alaska Petroleum Company.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: August 25, 1981

SUBJECT: EPA Response to Alaska Dept. of Environmental Conservation Air Quality Comments on PSD IV Technical Analysis for ARCO/SOHIO PSD IV Application

FROM: William Puckett, WP Meteorologist
Technical Support Branch (M/S 329)

TO: Michael M. Johnston, Chief
New Source Permits Section (M/S 521)

THRU: Robert G. Courson, WP for Chief
Technical Support Branch (M/S 329)

EPA responses to the Alaska Department of Environmental Conservation (ADEC) comments are as follows:

ADEC Comment 1 - Use of term "existing sources" in defining existing air quality is misleading.

EPA Response - Statements are made in the technical analysis referring to existing sources, previously permitted sources, and proposed sources. Also the time period (April 1, 1979 to March 31, 1980) during which monitoring was conducted is listed. For these reasons, the reader should be able to understand that the reference to "existing sources" in the monitoring study means the sources that were in operation at the time monitoring was conducted.

ADEC Comment 2 - There appears to be a discrepancy between the TSP values reported in Table 2 of the technical analysis and the TSP values listed in the applicant's report.

EPA Response - The maximum measured pollutant values in Table 2 were taken from Table III-7 of the Air Quality and Meteorological Monitoring Study at Prudhoe Bay, Alaska, Final Report, Radian Corporation, Jan., 1981. The maximum TSP values in the applicant's report were the second highest TSP values measured in the Prudhoe Bay Monitoring Study. Use of the second highest 24-hour TSP values measured during one year is more appropriate when comparing to the 24-hour TSP National Ambient Air Quality Standards (NAAQS) because NAAQS are interpreted as "not to be exceeded more than once per year" (40 CFR 50.6).

ADEC Comment 3 - Table 2 presents too much information in one table for a person unfamiliar with the project to grasp.

EPA Response - The purpose of Table 2 was to compare the maximum measured pollutant values and the background pollutant values with the National Primary Ambient Air Quality Standards. Use of more than one table to accomplish this could be confusing to the reader.

ADEC Comment 4 - Why were primary 24-hour TSP standards listed in Table 2 and secondary 24-hour TSP standards listed in Table 3?

EPA Response - The primary TSP standards were listed in Table 2 because "the intent was to compare the maximum measured pollutant values with the primary standards." Primary standards define levels of air quality which the Administrator judges are necessary, with an adequate margin of safety, to protect the public health (40 CFR 50.2b). Secondary TSP standards were used in Table 3 to show that predicted air quality levels would not exceed the less restrictive secondary standards. Technical evaluations are prepared with the assumption that the reader has some basic knowledge of air pollution problems so an explanation of every "technical term" used is not made. Therefore, an explanation of why primary TSP standards were used in Table 2 and why secondary TSP standards were used in Table 3 was not made.

ADEC Comment 5 - Comparison with the National Primary 24-hour TSP Standard of 260 ug/m^3 is irrelevant because the Alaska 24-hour Ambient Air Quality Standard for TSP is 150 ug/m^3.

EPA Response - The purpose of the EPA PSD air quality review is to demonstrate that no "National Ambient Air Quality Standards" would be violated by the proposed sources. This is clearly stated at the beginning of the air quality analysis in the technical evaluation as follows: " The air quality analysis must demonstrate that emissions of the above pollutants from the proposed additional sources will not cause or contribute to violations of any applicable National Ambient Air Quality Standards (NAAQS)." However, the Alaska 24-hour Ambient Air Quality Standard for TSP is the same as the National Secondary 24-hour Standard for TSP, which was used in Table 3 to evaluate impacts from the proposed sources.

ADEC Comment 6 - Use of "ISC" is not acceptable because the model is not listed in the Guideline on Air Quality Models (EPA-450/2-78-027).

EPA Response - EPA acknowledged in the technical evaluation that "ISC" is a nonguideline model, and that the results of the air quality analysis were based on "ISC". EPA also clearly stated in the technical evaluation the reasons for using ISC. This was stated as follows: The ISC Model was used in this air quality analysis because building-wake-induced downwash of pollutants was viewed as a potential problem, and the ISC Model is the most suitable available model for use in calculating downwash of pollutants.

ADEC Comment 7 - Fundamental and optional algorithms of the ISC Model must be compared with those of an approved model (i.e. TCM, which was previously used for analyzing Prudhoe Bay projects).

EPA Response - The ISC Model was compared with the CRSTER Model (An approved EPA Model) in the technical analysis. This comparison was based on a study titled, "An Evaluation Study for the Industrial Source (ISC) Dispersion Model," EPA-450/4-81-002, Jan., 1981. The results of this study showed that the building-wake effects option of the ISC Model significantly improves the performance of the ISC Model over that of the corresponding models (CRSTER and MPTER).

ADEC Comment 8 - Utilization of the building-wake effects option of the ISC Model for 100% of the time in predicting annual ambient exposures is not a valid assumption.

EPA Response - Use of the building-wake effects option in the ISC Model does not mean that the model will calculate downwash 100 % of the time. Whether or not ISC will calculate downwash is dependent upon plume rise and meteorological conditions. The criteria used by the ISC Model in determining whether or not downwash will occur is explained in detail in the Industrial Source Complex (ISC) Dispersion Model User's Guide, EPA-450/4-79-030, Dec., 1979.

ADEC Comment 9 - The random grid distribution used in the modeling analysis may result in an underestimation of ground-level pollutant concentrations.

EPA Response - The applicant used the random grid distribution in the air quality analysis for the sources because the

location, number, and sizes of specific future modules is changing as the design process continues. For this reason, use of this grid system is probably the most appropriate approach to the spacing of sources in the air quality analysis. There is some amount of uncertainty in all input parameters used in air quality models (e.g. meteorology, emission rates). Use of this grid system should not significantly add to the uncertainty of the final modeling results.

ADEC Comment 10 - A valid comparison cannot be made between general NO_2 impacts listed in the PSD I Application with general NO_2 impacts listed in the PSD IV Application because different models were used for each application.

EPA Response - EPA acknowledges that comparison of the TCM Model results of the PSD I Application with the ISC Model results of the PSD IV Application is not completely valid. However, using the TCM results in Figure 4-1 of the technical note entitled "Air Quality Impacts of the Prudhoe Bay Unit PSD-IV Sources as Estimated by the Texas Climatological Model (TCM-1)" in the comparison with the TCM results in the PSD I Application is still not completely valid due to the following: 1) Different sets of meteorological data were used in the modeling analyses of each application. 2) Impacts from the proposed AGCF sources were not included in the results displayed in Figure 4-1 of the above technical note.

In the above comparison, EPA merely intended to establish that continued construction of facilities in the Prudhoe Bay Oil Field will likely result in an overall increase in annual ambient NO_2 levels over the Prudhoe Bay area. However, the main purpose of an air quality analysis in a PSD application is to establish that no PSD increments or NAAQS will be violated. This was demonstrated by the PSD IV air quality analysis.

MEMO Subject: Response to Comments on PSD IV Prudhoe Bay

From: Paul Boye, ASIS

TO: Mike Johnston, NSPS

ARCO/SOHIO and ADEC raised two questions: one concerning the NO_x limitation for gas turbines; and the other concerning the NO_x limitation for the gas fired process heaters.

Basically, they suggested that the proposed 100 ppm NO_x limit for gas turbines would be too restrictive because it ~~reduced~~ reduces the number of turbine models they could choose from, and it tended to favor the least energy efficient turbines. They also thought the data base is too limited to reduce the NO_x limitation from 150 to 100 ppm. Although we have five source tests from turbines operating in Alaska for which the NO_x emissions are less than 100 ppm, we have concluded that it isn't worth pushing this issue. Their arguements about energy efficiency and reduced choice of turbines are at least directionally correct.

One of the reasons we proposed to change the NO_x emission limitation to 100 ppm was to be able to use this lower emission rate in the air quality modeling which is beginning to crowd

the NAAQS for NO_2. Since the company doesn't appear concerned about this restricting their future growth, there doesn't seem to be any reason for EPA to be concerned for them.

Therefore, I recommend that we revise the gas turbine emission to 150 ppm to be consistant with NSPS and our previous PSD permits.

The second issue is related the ~~the~~ NO_x emission limitation for the gas fired process heaters. They questioned the lb/10^6 BTU value - suggesting the 0.08 lb/10^6 BTU limitation should be 0.10 lb/10^6 BTU. I have checked our references for the 0.08 lb/10^6 BTU limitation, and I find no reason to change it. If the company has further questions, they can call or visit me for clarification.

The company also suggested that they may install some smaller heaters than they originally thought, and they wanted a split NO_x emission limitation similar to the ones for Increment II and waterflood.

The reason for the split NO_x emission limitation in the previous PSD permit was that the smaller ones were going to be space heaters rather than process heaters. Without more specific knowledge of their design characteristics we decided to not require any control (low-NO_x burners) on the space heaters. As far as I can determine, all the units in PSD IV are process heaters which should be able to use low-NO_x burners. In the past we have made a distinction between small natural draft heaters and the larger ones. Basically, the smaller natural draft heaters cannot safely operate at excess air rates less than 15%; and therefore, can not meet the 0.08 lb/10^6 BTU NO_x emission limitation. For those small natural draft heaters we set a different NO_x emission limitation of 0.10 lb/10^6 BTU. (as in Alaska LNG PSD).

~~Therefore, I recommend~~
not having a clear definition from the company as to the size break which separates the small natural draft process heaters from the others, I suggest we use the same size cut-off as in the previous

PSD permit for Prudhoe Bay (43×10^6 BTU/hr). Therefore, I recommend that the gas fired process heater emission limitations be as follows:

Process heater size (10^6 BTU/hr)	NO_x emission limitation (lb/10^6 BTU)
< 43	0.10
> 43	0.08

If you have any questions about these recommendations, please call me.

SOHIO ALASKA PETROLEUM COMPANY

3111 "C" STREET
ANCHORAGE, ALASKA

TELEPHONE (907) 276-5111

MAIL: POUCH 6-612
ANCHORAGE, ALASKA 99502

August 18, 1981
cc #38,499

Mr. Tom Chapple
Alaska Department of Environmental Conservation
Pouch O
Juneau, Alaska 99811

Dear Sir:

In response to your letter of July 14, 1981 requesting additional information regarding Best Available Control Technology for gas fired turbines, the following information is provided:

1. "Comments on the Preliminary Determination for a PSD Permit Application for New Sources to be Added to Existing and Previously Permitted Facilities in the Prudhoe Bay Unit (PSD IV) submitted to your office under separate cover on August 14, 1981.

2. Discussion on gas turbine emissions control methods written by Solar Turbines International which includes information on two stage combustion.

Please call me if there are any questions.

Mark R. Wagner

M. R. Wagner
Environmental Engineer

Attachments

cc: Mr. Michael Johnston - EPA, Seattle
Mr. Doug Lowery - ADEC, Fairbanks
Mr. Jim Sweeney - EPA, Anchorage

MRW/kg

GAS TURBINE EMISSION CONTROL METHODS

There are three control methods now being investigated for controlling emissions from gas turbine engines:

- Wet method - water or steam injection
- Dry method - combustion system design
- Use of catalysts

Of the three, only the wet method has been proven as a working system for NO_x control. The wet method, however, usually has an adverse effect on other pollutants, increases fuel consumption, and has a disproportionate economic impact on small gas turbines.

The catalytic combustion method has not been proven feasible on a gas turbine, but is still being investigated.

The dry method of NO_x control has not been proven feasible on full scale turbines, but has the potential of being the most economic and practical control method. Dry methods have been demonstrated on subscale laboratory combustion tests. In addition, they can also control CO and HC emissions with no increase in fuel consumption. Unfortunately the dry control development costs and time are far greater than the alternative systems.

Solar at present is pursuing solutions to the wet and dry methods of emissions control for our turbines. The following discussion of the three control methods should help clarify the reasons for Solar's decision to pursue the dry methods of emissions control in spite of the large investment of time and money required.

USE OF CATALYSTS

Over the past several years, there has been a great deal of interest in the possible use of catalytic reactors to eliminate NO_x from the gas turbine exhaust gas. The interest stems from the progress being made in developing such devices for automotive gasoline engines. At present, these devices (for automobiles) are still under development.

Several Japanese companies have been developing this type of NO_x control technology and applying it to various types of chemical processing plants, industrial boilers, and coke ovens that emit NO_x. Because many of these plants are located in densely populated areas, the pollution problem has been very severe. Several chemical and industrial boiler plants using this type of NO_x control system are already in operation today. Application to gas turbine exhaust has not been effectively demonstrated.

Basically, the process works by injecting ammonia gas (NH_3) into the exhaust gas stream. The gases then pass through a catalytic reactor bed that reduces the NO_x to nitrogen plus water. The basic reaction equations are as follows:

$$6\ NO + 4\ NH_3 \rightarrow 5\ N_2 + 6\ H_2O$$

$$6\ NO_2 + 8\ NH_3 \rightarrow 7\ N_2 + 12\ H_2O$$

The United States Environmental Protection Agency was interested in the process several years ago, but at present are not working on this method of NO_x control.

Although the process appears promising, it is not now considered an operational, available technology to gas turbine exhausts. Factors that have discouraged the development of this NO_x control system for gas turbines include:

1) The lower emissions of turbines do not warrant it.

2) Alternative systems can be used for more cost effective reduction.

3) The gas turbine exhaust contains about 15% oxygen rather than the 3% in industrial boilers and the Japanese chemical plants where the process has been applied. Since the process must take away oxygen from NO_x, the extra oxygen in the gas turbine exhaust discourages the reaction.

4) Present available catalysts are effective over a very narrow temperature range. In most cases the exhaust gas must be heated or cooled to allow the catalyst to operate.

5) Sulfur in the fuel tends to poison the catalyst.

6) The system requires high energy, since large blowers must be used to overcome the pressure drop of the catalyst bed.

7) The potential release of free ammonia to the environment constitutes a much worse pollutant than NO_x. At higher temperatures, NH_3 oxidizes to form NO_x, a self-defeating process.

8) The life of the catalyst is estimated to be about one year. The replacement cost of the catalyst for a 10,000 hp gas turbine is estimated to be about one million dollars.

Another method under investigation is to use catalytic combustion. This allows combustion at temperatures so low that NO_x does not form. This system does not yet have significant experience and the cost may preclude its commercial viability.

WET METHOD OF NO_x CONTROL

The only presently existing working method for NO_x control in gas turbines is the wet method. In this method, water or steam is injected into the combustion chamber to reduce peak combustion temperatures, which leads to lower NO_x formation. The wet method, although workable, introduces many complex difficulties and costs into the basically simple gas turbine engine. Some of these problem areas are:

Economics

- To achieve low NO_x levels, water-to-fuel ratios of up to 1-to-1 may be required. That is, for each kilogram of fuel burned, a kilogram of water must also be injected into the combustion chamber.
- The water quality must be very high; it must contain less than 0.5 parts/million by mass of sodium plus potassium and less than 1.0 parts/million by mass of all other dissolved solids.
- Water of this quality must be prepared by special treatment facilities. Starting with city or well water, a workable system could require a reverse osmosis system followed by one or two stages of a deionization system.
- In some areas, fresh water supplies are not available.
- For cold climate operation, heaters are required to keep the water from freezing.
- The efficiency of the turbine is reduced 1.5 to 2.0 percent; that is, with water injection, the engine will use up to 2.0 percent more fuel to produce the same power.

Mechanical Problems

- Water of the quality required is very corrosive and, therefore, increases maintenance costs.
- The water treatment plant is complex and requires maintenance because of the corrosiveness of the water and the nature of the process.
- Remote stations or automatic station operations is made more difficult by the demands of the water treatment facility and the engine water control system.

Emission Problems

- Although there is a substantial reduction in NO_x, there is usually an increase in carbon monoxide and hydrocarbons in the exhaust. In certain locations where these other pollutants are a problem, water injection cannot be used.

DRY METHOD OF NO_x CONTROL

In all engines the generation of NO_x is directly related to high combustion temperatures and the time interval required for the combining of oxygen and nitrogen. Basically, therefore, to attain low NO_x emissions the combustion process must be carried out at a low temperature and in the shortest time. In addition, to maintain low emission levels of CO and UHC, the temperature must be high enough to allow sufficient time to complete their reaction of fuel with oxygen. As can be seen in Figure 1-2, this can be accomplished by burning at very lean mixtures (i.e., high air/fuel ratios) or with staged combustion (i.e., rich combustion followed by lean combustion). Research indicates that combustion temperatures must be within a range of 2200 to 3100°F to hold all emissions to an acceptable level.

Although this requirement is contradictory to the process by which the piston engine derives its power, and is difficult to accomplish within the confines of the cylinder, this is not the case with the gas turbine. The gas turbine combustor is relatively insensitive to shape and size in regard to its ability to operate efficiently. This gives the designer much greater freedom to modify and arrange the combustor so that it can operate at low combustion temperatures. Burning fuel efficiently at low temperatures requires that:

- The fuel be thoroughly evaporated and uniformly mixed with air before burning
- Burning the mixture takes place uniformly and as rapidly as possible
- Additional (secondary) air be added downstream of the combustion zone to assure complete burning of CO and UHC
- The combustor liner wall temperature be high enough to eliminate fuel quenching, reducing the tendency to form CO, UHC, and smoke.

In the traditional combustor design, the primary concern is stable combustion over all engine operating conditions with good combustion efficiency. This is accomplished by establishing a central combustion zone that will burn at near stoichiometric conditions (15/1 air fuel ratio). This approach accomplishes stability and efficiency objectives, but the resulting high combustion temperatures produce NO_x levels that are higher than attained otherwise.

By modifying the combustor, the combustion process can be controlled to a lower temperature. As an example, in the staged combustion method, primary air can be mixed with the fuel to produce a homogeneous mixture of air and fuel vapor. This rich mixture would be burned in the primary combustion zone to maintain a combustion temperature less than 3000°F. Secondary air brought in through the combustor liner downstream from the combustion zone would complete the burning process, control the combustion liner metal temperature, and dilute the combustion gas to the proper operating temperature level.

In comparing the two methods, all of the deficiencies noted previously for the wet method are eliminated by the use of dry method control of NO_x. Briefly, dry methods would:

- Effectively decrease NO_x emissions.
- Do not decrease thermal efficiency or increase fuel consumption.
- Do not increase carbon monoxide or hydrocarbon emissions.
- Do not increase the complexity of the turbine or its control system.
- Do not require water or other fluids or materials.
- Allow the continuing use of remote, unmanned power stations.
- Do not increase the maintenance of the turbine significantly.
- Do not affect the operating characteristics of the turbine.

In light of the above, Solar believes the advantages of the dry-method approach to control NO_x warrants the cost of development. Solar, therefore, has been applying substantial resources toward dry methods of NO_x control.

STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

JAY S. HAMMOND, GOVERNOR

465-2666

POUCH O — JUNEAU 99811

CERTIFIED MAIL
RETURN RECEIPT
REQUESTED

Mr. Michael Johnston
New Source Permits Section
Environmental Protection Agency
Region X, M/S 521
1200 Sixth Avenue
Seattle, Washington 98101

Dear Mr. Johnston:

The Department has received the information transmitted with your letter of 1 July 1981 regarding the proposed installation of additional air contaminant emission sources to be located in the Prudhoe Bay oil field. These materials in addition to a copy of the document entitled PSD Permit Application for New Sources to be Added to Existing and Previously Permitted Facilities in the Prudhoe Bay Unit (PSD IV) are currently available for public inspection at our office.

Concerning your document entitled Technical Analysis for Prevention of Significant Deterioration ARCO/SOHIO - Prudhoe Bay, Alaska, May 20, 1981 the Department has the following comments, questions and concerns:

BEST AVAILABLE CONTROL TECHNOLOGY

° A Best Available Control Technology determination of 100 ppm of nitrogen oxides emission for these gas fired turbines has been made. This decision was based upon previously performed source tests of similar turbines located at or near Prudhoe Bay, Alaska and an indication that a turbine manufacturer may in the near future guarantee a turbine (over 40 MHP) to meet the nitrogen oxides exhaust criteria of 100 ppm.

- Who is the turbine manufacturer(s) and when will these units become available? Since the turbine which will to meet this criteria is larger than any of those proposed for this project, how is the applicability justified, and what is the anticipated date of availability for turbines of less than 40,000 horsepower which also meet the 100 ppm NO_x criteria?

- Is it anticipated that no change in turbine design, type or operation is required for these turbines to meet the criteria? If so, is the applicant solely responsible for meeting the criteria since manufacturers are not presently guaranteeing available equipment to meet the 100 ppm NO_x specification.

° What information (i.e. source tests, continuous NO_x monitoring data or other) is available from existing facilities to indicate the reliability and acheivability of low NO_x burners for process heaters to comply with the 0.08 lb. NO_x/MM BTU BACT limitation. Is there an associated efficiency penalty?

EXISTING CONDITIONS

° In Section IIIA of the document, the statement is made regarding existing air quality: "The maximum values measured at Site 1 and Site 2, while not representative of maximum impacts, may be considered as representative of typical downwind impacts resulting from existing sources."

- This statement is misleading since the monitoring was performed when the number of operating emission sources was low compared to the number of emission sources currently permitted which constitutes "existing sources" for purposes of evaluating this application. Hence, those pollutant concentrations which were measured in 1979-80 as a result of the then existing and operating pollutant sources are not representative of the ambient impacts of all existing (i.e., permitted) sources. The basic objective of the monitoring program was to establish ambient background pollutant concentrations. Two monitoring sites were selected such that the data would not be biased from the pollutants emitted from construction and then existing source operations.

° There appears to be a discrepancy between two of the values reported in Table 2 and the values reported in the applicants' report. Maximum measured TSP concentrations for a 24 hour period at Sites 1 and 2 are reported in Table 2 to be 112 and 294 ug/m^3 respectively. However, Table 4-2 of the applicants' report indicated the maximum TSP concentration for a 24 hour period are 119 and 64 ug/m^3 respectively for the two sites.

° In general, Table 2 presents too much information in one table for a person unfamiliar with the project to grasp. I would suggest one table be used to illustrate the ambient background concentrations relative to the ambient standards, while another be used to portray the maximum measured pollutant values as generated by the sources existing at that time.

° The national ambient air quality standard for TSP (24 hour) is illustrated to be 260 ug/m^3 in Table 2. Although this is the primary standard, the secondary standard of 150 ug/m^3 is displayed as the NAAQS in Table 3. This inconsistency can be confusing for the reader, if one is not completely familiar with the standards. Also, the Alaska ambient air quality standard for TSP is 150 ug/m^3 and not 260 ug/m^3. Therfore any comparison with 260 ug/m^3 is irrelevant.

MODEL METHODOLOGY

° Criteria for acceptable air quality models are specified in 40 CFR 52.21 (m) (1) for new sources to be constructed in areas classified for the Prevention of Significant Deterioration. The regulation states "All estimates of ambient concentrations required under this section shall be based on the applicable air quality models, data bases, and other requirement specified in the Guideline on Air Quality Models (OAQPS 1.2-080, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N. C. 27711, April 1978)". Paragraph (m) (2) of the same regulation stipulates that an applicant may utilize a modification of a current model or substitute a different model that may be more appropriate if the modification or model has been subject to public review and approved by the Administrator of the USEPA. These regulations clearly suggest that it is the applicant's responsibility to select a model best suited to the specific conditions which are to be modeled. The ISC model which was used at the request of EPA is not contained in the 1978 Guideline on Air Quality Models nor have the 1980 proposed revisions to the guideline been approved by the Administrator. Therefore, use of the model at this time is not acceptable for estimating air quality impacts of these proposed activities (FR 3-27-80, p. 20158).

° Regardless of the status of this model's acceptance, the fundamental and optional algorithms of the ISC model must be compared with those of an approved model (ie. the Texas Climatological Model previously used for analyzing Prudhoe Bay projects) as outlined in the Workbook for Comparison of Air Quality Models, May 1978 (EPA - 450/2-78-028a). No comparisons were presented in the application.

° Utilization of the building wake option of the ISC model for 100% of the time in predicting annual ambient exposures is certainly conservative, but probably is not a valid assumption for simulating actual field conditions. It may however be applicable and informative for projecting ambient impacts when exposure times are 24 hours or less (ie. 24 hr. TSP, 3 hr. and 8 hr. SO_2) or possibly identifying physical locations which may exhibit high nitrogen dioxide concentrations for short exposure times. If the short-term nitrogen dioxide concentrations are found to be sufficiently high (say, 5 to 10 times the annual standard) because of stack downwash, then it would be warranted to investigate through the annual meteorological data the relative frequency of this occurrence.

° Random grid distribution of several individual point sources at one facility as described in Section III C is a deviation from previous modeling practises used for Prudhoe bay. In the past modeling activities, all emissions at a single facility were modeled as a single exhaust stack. Clearly, the previous procedure resulted in an overestimate of ground level pollutant concentrations. However, this method of randomly spacing the source may result in an underestimation of ground level pollutant concentrations since in reality some facilities may locate several sources in a row (i.e. turbines) where each exhaust stack is only separated by 10 to 40 feet, possibly in-line with the prevailing winds.

° The ambient ozone assessment presented in the technical analysis is a reasonable and sensable approach to analyzing possible ozone generation due to hydrocarbon emissions with respect to north slope atmospheric conditions.

MODEL RESULTS

° When presenting the model results for impacts of nitrogen oxides, the statement is made; "It should be noted, however, that even if NO_2 impacts to the lee of buildings are ignored, the addition of previously permitted and proposed source of NO_x will result in a general significant increase (20 ug/m^3 to 30 ug/m^3) in NO_2 levels in the Prudhoe Bay area".

- This is a very difficult projection to make since completely different models and algorithims are being used in the two different analyses. Use of the downwash option has not allowed the determination of maximum pollutant positions and respective concentrations during non-downwash conditions. When examining the two referenced figures, it appears that the projected ambient NO_2 increase is about 20 to 30 ug/m^3 as stated. However, if the previously permitted sources and these proposed sources are modeled with the same model (TCM) as used, a more valid comparison can be made regarding the anticipated increase in NO_2 impacts. This can be done by comparing the projected ambient NO_2 levels of Figure 9.2-3 of PSD I with Figure 4-1 of the Technical note entitled Air Quality Impacts of the Prudhoe Bay Unit PSD-IV Sources as Estimated by the Texas Climatological Model (TCM - 1), 1 June 1981 submitted to the Alaska Department of Environmental Conservation by SOHIO Alaska Petroleum Company and ARCO Alaska Inc. on behalf of the Prudhoe Bay Unit Owners. It is apparent that the projected increase of annual ambient levels of nitrogen dioxide of all facilities after the PSD-I application are approximately 5 to 10 ug/m^3 and the total maximum annual ambient NO_2 concentration is projected to be 28 ug/m^3 from all Prudhoe Bay Unit activities.

COMPLIANCE DETERMINATION

° The source testing and monitoring criteria established for assuring the applicants' compliance with the established emission limitations are acceptable to this Department. We would however suggest that annual testing of the turbine fuel be performed rather than the daily fuel testing requirement specified in 40 CFR 60.334.

Sincerely,

Thomas W. Chapple
Environmental Engineer III

cc: D. F. Dias, SOHIO Petroleum Co.
W. P. Metz, ARCO Alaska Inc.
Doug Lowery, NRO, Fairbanks

August 13, 1981

Region Administrator
Region X
U.S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, Washington 98101

Attention: Mr. Michael Johnston

Subject: Comments on the Preliminary Determination for a PSD Permit Application for New Sources to be Added to Existing and Previously Permitted Facilities in the Prudhoe Bay Unit (PSD IV).

Dear Sir:

A Preliminary Determination was issued by the USEPA, Region X for the above referenced PSD permit application. Notice for public comment was published in the Anchorage Times on July 16, 1981. Sohio Alaska Petroleum Company and ARCO Alaska, Inc., on behalf of the Prudhoe Bay Unit Owners, submit for your consideration the attached written comments regarding this Determination.

We would be pleased to discuss these comments with you at your earliest convenience.

Very truly yours,

Kevin C. Myers
Kevin C. Myers
ARCO Alaska, Inc.

Mark R. Wagner
Mark R. Wagner
Sohio Alaska Petroleum Company

Attachments

cc: Mr. Stan Hungerford, ADEC - Juneau
Mr. Doug Lowery, ADEC - Fairbanks
Mr. Jim Sweeney, EPA - Anchorage

KCM/MRW/kg

COMMENTS ON THE PRELIMINARY DETERMINATION FOR A PSD PERMIT APPLICATION FOR NEW SOURCES TO BE ADDED TO EXISTING AND PREVIOUSLY PERMITTED FACILITIES IN THE PRUDHOE BAY UNIT (PSD IV).

Submitted: August 13, 1981

1. The Preliminary Determination states that available information from vendors and source tests shows that 100ppm NO_x emissions from gas-fired turbines is "reasonably achievable and, therefore, is established as BACT for this project." It is the Applicant's position that the NSPS emission limit of 150ppm NO_x is appropriate, and that any reduction of that emission limit is not justifiable for the following reasons:

   a. Discussions with members of your staff concerning the proposed 100ppm NO_x emissions limitation indicated that "information available from vendors" consists of limited verbal information only. While these verbal discussions may be adequate for rough estimates, they do not carry the same weight as a written emission guarantee from a turbine manufacturer and should not be relied upon to establish BACT. To provide an adequate data base, the Applicant has compiled emissions data on turbines which have been ordered for the Prudhoe Bay Unit during the last 12-18 months. The guaranteed NO_x emission rates for these turbines are as follows:

Capacity or ISO HP	Manufacturer	Cycle Type (1)	Guaranteed NO_x PPMV (3)
36,000	Cooper Rolls	R/C	206 (2)
35,000	G. E.	S	122
33,550	G. E.	R/C	208 (2)
32,000	G. E.	R/C	216 (2)
31,000	G. E.	S	111
25,000	G. E.	S	80
7,700	Sulzer	R/C	147
4,900	Ruston	R/C	150
1,200	Solar	S	75

Notes: (1) R/C indicates regenerative or combined cycle; S indicates simple cycle
(2) 150ppm adjusted upwards for thermal efficiencies above 25%
(3) Based on 15% O_2 on a dry basis at ISO conditions

Of the nine turbines listed, only two can be guaranteed to meet a 100ppm NO_x limitation; a 25,000 HP simple cycle G. E. and 1200 HP Solar. In addition, six of the nine are guaranteed at 147ppm or higher and range in size from 4,900 to 36,000 HP. The remaining two are 31,000 HP and 35,000 HP simple cycle G. E. turbines which are guaranteed at 111ppm and 122ppm respectively.

While the range of emissions from gas-fired turbines fluctuates with the size, configuration, and design of the turbines listed, all of the turbines can satisfy the NSPS level of 150ppm NO_x with dry controls. Most of the manufacturers indicated that wet controls would be necessary to achieve further NO_x reductions. The Preliminary Determination correctly states that the costs associated with the aquisition and treatment of water for wet controls on the North Slope are extremely prohibitive. To design the facilities necessary for continued oil field development in Prudhoe Bay, our engineers need the flexibility to consider fuel efficiency, capital cost, maintenance, turbine design, equipment availability, as well as environmental considerations in their selection of turbines.

It is important to recognize that at any given horsepower size (5 MHP, 15 MHP, 30 MHP) NO_x emission rates will vary considerably, depending on the firebox design, firing temperature, whether or not it is a simple cycle or regenerative cycle, twin shaft or single shaft, aircraft derivitive or industrial type of turbine. Any of these features or designs can be necessary, depending on the needs of a particular project. To apply the emission capabilities of one manufacturer's specifically sized turbine to other turbines of the same size and to other turbines of different capacities "across the board" is totally inappropriate. Such action severely limits turbine design flexibility and project design flexibility.

The following is offered as one example of the potential impacts on project optimization of the proposed NO_x emissions limit reductions for gas fired turbines.

As part of the Prudhoe Bay Unit Waterflood Project, ARCO has purchased (3) Cooper-Rolls combined cycle 29,100 bhp Coberra 6056 units (87,300 total horsepower) for use at their Seawater Injection Plant. The combined cycle feature is important in that the heat recovered from the exhaust gases will be used to assist in increasing the seawater temperature from 40^{o} F to 80^{o} F. These turbines are guaranteed at 206ppm (150ppm adjusted). In order to meet a 100ppm NO_x limitation, smaller horsepower simple cycle machines would need to be installed. The Cooper-Rolls 20,500 bhp simple cycle Coberra 2556 can meet a 100ppm NO_x limitation. However, in order to meet the total horsepower requirement (approximately 90,000 HP) five (5) or the turbines would need to be purchased.

This would represent an incremental capital cost of approximately $5.8 million for the turbines. Regarding operational and maintenance costs, the use of (5) Coberra 2556 units would result in incremental fuel costs of approximately $1.3 million/year primarily due to the lower efficiency of that turbine. This lower efficiency translates into an increase in energy consumption of approximately 1.6×10^{12} BTU/Year. In addition, another module would be needed (3 modules instead of 2) to house the five machines at an incremental cost of approximately $8.3 million. This represents a total incremental capital cost of approximately $14.1 million and an annual incremental operational and maintenance cost of approximately $1.3 million. Estimates to replace the loss of the waste heat recovery feature have not been calculated. In summary, a reduction of the NO_x limit below 150ppm, as EPA Region X has proposed, could significantly increase capital, operational and maintenance costs, energy consumption and severely hamper engineering design flexibility.

b. It is our understanding that the source test data referred to in the Preliminary Determination consists of a compliance test for one Alyeska turbine at Pump Station No. 2 and a single source test of each of three Prudhoe Bay Unit turbines. While the test results indicate that the NO_x emissions from these turbines were below 100ppm on the day they were tested, it is unreasonable to extrapolate <u>maximum</u> emissions limits for all turbine sizes from this small data base. Test results of emissions can vary significantly for a single machine from month to month, day to day and even hour to hour. A review of the American Gas Association's Compilation of Emission Data will verify this point. Scientifically sound conclusions regarding turbine NO_x emission rates on the North Slope can only be made after numerous tests are conducted, under varying conditions. It is anticipated that this data base will accumulate over the next several years, as the Prudhoe Bay Unit and other North Slope operators perform necessary compliance testing.

c. Extensive air quality data collected during a one year pre-construction monitoring program in 1979-80 indicated that the background NO_2 concentration in the Prudhoe Bay area was $2\mu g/m^3$. Modelling results presented in the PSD IV permit application indicate that an additional $62\mu g/m^3$ of NO_2 may be generated by existing, previously permitted, and proposed Prudhoe Bay Unit sources. Conservative assumptions used in the modelling analysis (not conservative emission rates) would likely cause the actual NO_2 concentrations to be significantly less than predicted values. Therefore, the annual NAAQS of $100\mu g/m^3$ NO_2 is in no apparent danger of being exceeded.

d. It is generally recognized that the purpose of New Source Performance Standards (NSPS) is to insure that the best technology, considering economics, is used to limit pollutant emissions from new sources. NSPS are established after careful scrutiny by industry and environmental regulatory agencies alike. It then follows that NSPS adequately satisfy the requirements of Best Available Control Technology (BACT) and therefore BACT should be no more stringent than NSPS.

New Source Performance Standards (NSPS) for gas fired turbines, promulgated on September 10, 1979 established, among other things, NO_x emission limits for turbines in oil and gas production/transportation. For facilities in an area such as Prudhoe Bay the NO_x limit for large turbines (greater than or equal to 107.2 gigajoules/hr.) would be set at 150ppm. For smaller turbines (between 10.7 and 107.2 gigajoules/hr.) the 150ppm limit does not apply until October 3, 1982. Manufacturers and consumers (industry), since the promulgation of these regulations, have incorporated these NO_x limitations into their long range planning efforts. The proposed BACT NO_x limit of 100ppm, which is a significant reduction from NSPS levels, causes a great deal of difficulty from a planning viewpoint. Further reduction in the NO_x limits for large turbines without adequate lead time and on the smaller turbines a year before the NSPS limit of 150ppm NO_x applies, is not justified.

When the following are taken into careful consideration it becomes quite apparent that no reduction in the existing NO_x limit of 150ppm is justified:

1. manufacturers written guaranteed emissions data

2. Engineering constraints for turbine selection including costs and energy consumption

3. insufficient source testing data base

4. lack of any NO_x pollution problem at Prudhoe Bay

5. appropriateness of using the NSPS limitation (150ppm) for gas fired turbines as BACT.

2. Although the ISC model was used in the air quality analysis for this PSD application, it was used at the strong urging of EPA, Region X, not at the request of the Applicant. The Applicant had proposed to use models that were on the current approval list and which had been used successfully on three previous PSD application filed within the past 12-18 months. However, due to project time constraints and potential costs associated with project delays the Applicant consented to the use of the ISC model. This was done recognizing that the ISC model produced results that were more conservative than those models that had been acceptable in our previous PSD applications. The Preliminary Determination correctly states that "The ISC Model is not listed as a recommended model in EPA's 'Guideline on Air Quality Models' (EPA-450/2-78-027 April, 1978) which is currently in force", and that "At this time, the ISC Model has not been thoroughly evaluated and it is still being tested." It appears clear that although the ISC Model may be acceptable once it has been "debugged", its use should be discontinued until it receives formal approval by the EPA Administrator.

3. In the technical analysis of the Preliminary Determination an emissions limit of .08 lb NO_x/MMBTU was proposed for all gas fired heaters. The basis for this emissions limit is described in the EPA, Region X Technical Analysis Document for the Prudhoe Bay Unit Produced Water Injection, Low Pressure Separation, Artifical Lift PSD Permit (PSD-X80-09) dated June 13, 1980. The emissions limit was incorrectly calculated using methane as the fuel. Based on actual field fuel gas composition the NO_x limit should be 0.10 lb NO_x/MMBTU as shown in the attached calculations.

   Also, in PSD-X80-09 an NO_x emissions limit of 0.19 lb NO_x/MMBTU was set for gas fired heaters smaller than 43MMBTU/hr. The heater sizes for the facilities under consideration in this PSD application have not been finalized but are proposed to range from 25 to 125MMBTU/hr. To remain consistent with the previous PSD, it is requested that units less than 43MMBTU/hr. have emission limits of 0.19 lb NO_x/MMBTU. Units larger than 43MMBTU/hr. will use low NO_x burners and have an emission limit of 0.10 lb NO_x/MMBTU.

4. On page one of the Preliminary Determination, last paragraph under "Findings", the fifth line should read 303 thousand horsepower not "303 million horsepower".

5. In order to more clearly identify the applicants any reference to Atlantic Richfield Company should be changed to ARCO Alaska, Inc. and Sohio Petroleum Company to Sohio Alaska Petroleum Company.

ATTACHMENT

Gas Fired Heater NO_x Emissions Calculations

Calculate the Equivelent Emission for 70ppm NO_x in lb NO_x/MMBTU.

$$\text{Emission (lb } NO_x\text{/MMBTU)} = (70\text{ppm } NO_x)\left(\frac{46 \text{ lb } NO_x}{\text{mole } NO_x}\right)\left(\frac{1 \text{ cu. ft. fuel}}{914 \text{ BTU}}\right)\left(\frac{1 \text{ mole fuel}}{386.6 \text{ ft.}^3}\right) \quad x$$

$$x\left(\frac{10.6 \text{ moles stack gas}}{1 \text{ mole fuel}}\right)$$

$$= 70/725 \quad \text{lb } NO_x\text{/MMBTU}$$

$$= .1 \text{ lb } NO_x\text{/MMBTU}$$

X 08/13/81 to Dave Tetta m/s 345
JJ Brown

GENERAL ELECTRIC

GAS TURBINE
DIVISION

GENERAL ELECTRIC COMPANY, ONE RIVER ROAD, SCHENECTADY, NEW YORK 12345
Telephone
(518) 385-4131

OPERATIONAL PLANNING

August 4, 1981

EPA, Region X
Regional Library, 12th Fl.
1200 Sixth Avenue
Seattle, Washington 98101

Attention: Mr. Michael Johnston

Dear Sir:

NOx Limits for Gas Turbines at Prudhoe Bay, Alaska

We take this opportunity to comment on the "Notice of Application to Construct and Preliminary Determination - Atlantic Richfield Company/SOHIO Petroleum Company".

Our concern is primarily with the proposed NOx limit of 100 ppmv at 15% oxygen, with allowance made for thermal efficiency correction. The determination that this level is Best Avabilable Control Technology (BACT) for gas turbines employed in the gas or oil production, or gas or oil transportation in the Prudhoe Bay area appears to contradict directly what the EPA Standard Setting Branch, out of Durham, North Carolina, stated in September 1979 and reaffirmed in April 1981.

In the September 10, 1981 (page 52796) Federal Register, EPA stated that:

> "...the promulgated standards (150 ppmv at 15% O_2) require gas turbines employed in oil and gas production or oil and gas transportation which are not located in a Metropolitan Statistical Area (MSA), to meet an NOx emission limit based on the use of dry controls."

In making the above statement, EPA clearly recognized that 150 ppmv at 15% O_2 is the best that can be accomplished without water or steam injection, and until the dry control technology has been successfully demonstrated to do better than the 150 ppmv, and is commercially available, the 150 ppmv at 15% O_2 shall be treated as Best Available Control Technology for gas turbines employed in gas/oil production or transportation.

This thinking was reaffirmed by EPA in the April 15, 1981 Federal Register, where the 150 ppmv at 15% O_2 is retained for gas turbines, employed in gas/oil production or transportation, located outside the metropolitan statistical areas. EPA's doubt that even this level can be achieved by all manufacturers is manifested in the total exemption from any NOx limits for

1076 gas gonerator hr. 100 million BTU

gas turbines in gas/oil production or transportation located within a MSA. If EPA were convinced that 150 ppmv can be attained by all manufacturers without water or steam injection, then there would have been no need for a dual standard. The reason for a total exemption in a MSA was to make sure that water/steam injection would not be necessary.

Therefore, it appears to us that the setting of a new standard of 100 ppmv at 15% O_2, with correction for thermal efficiency, by Region X is arbitrary and without adequate justification of a cost/benefit analysis. This level is achievable with water or steam injection, which has an affect on the heat rate of the machine. This standard cannot be met by all of our machines on a dry basis and could, conceivably, eliminate the use of the more efficient machines that can meet the EPA-determined BACT level of 150 ppmv at 15% O_2 for gas turbines used in gas/oil transportation or production application, using natural gas as shown in Table 1. It should also be noted that the 150 ppmv cannot be met in some cases using distillate fuel, which would most likely be a back-up fuel during periods when natural gas is unavailable. Therefore, some provisions should be made for emergencies where the 150 ppmv limit can be exceeded while operating on distillate fuel.

We urge Region X to set a NOx emission limit of 150 ppmv at 15% O_2, with allowable corrections for thermal efficiency and fuel bound nitrogen. Provisions should also be made for exceedances during emergency use of distillate fuel.

We would be glad to answer any questions that you may have related to this subject.

Sincerely,

Amarjit Singh Gill.

A.S. Gill,
Environmental/Regulatory Planner

/eb
Attach.

TABLE I

ABILITY TO MEET EPA NOx LIMIT OF 150 PPMV (DRY) AT 15% O_2

WITHOUT CONTROLS

Model	Natural Gas(1)	Distillate(2)
M3142 (J)	Yes	No
M3142R(J)	Yes	No
M5262 (A)	Yes	Yes
M5252R(A)	Yes	No
M5352 (B)	Yes	No
M5322R(B)	Yes	No
M5251 (R)	Yes	Yes
G3142 (J)	Yes	No
G3142R(J)	Yes	No
G5261 (R)	Yes	Yes
G5361 (P)	Yes	No
G6461 (B)	Yes	No
G7111 (E)	Yes	No
LM2500	Yes	No

(1) Lower Heating Value = 21515 Btu/lb.
H = 25.13% by weight

(2) Lower Heating Value = 18550 Btu/lb.
Fuel Bound Nitrogen = 0.015% by weight
H = 12.99% by weight

ASG
7/21/81

Ray

STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

465-2666

JAY S. HAMMOND, GOVERNOR

POUCH O – JUNEAU 99811

July 14, 1981

Mr. W. P. Metz
Senior Environmental Engineer
ARCO Alaska, Inc.
P. O. Box 360
Anchorage, Alaska 99510

Dear Pat:

This letter is to inform you of the Department's comments concerning the document entitled PSD Permit Application for New Sources to be Added to Existing and Previously Permitted Facilities in the Prudhoe Bay Unit (PSD-IV). As discussed in our meeting of April 16, 1981, several major concerns exist with the subject document which have been itemized in the attached document. The supplemental technical note entitled Air Quality Impacts of the Prudhoe Bay Unit PSD IV Sources as Estimated by the Texas Climatological Model (TCM-1), which you have provided as a result of our April meeting, has clarified several major concerns regarding the most likely ambient nitrogen dioxide impacts of these proposed facilities. However, it must be recognized that the technical note does not officially alter the PSD application.

For purposes of acquiring the necessary State permit, the following information must be submitted to the Department:

1. A request for a State permit or amendments to existing permits on a signed application form that refers to the equipment at each location.

2. Additional information regarding the use of Best Available Control Technology for the gas turbines to be installed for this project. Please see the appropriate comments in the attached document.

3. An indication that all proposed emissions sources will comply with all applicable state air quality standards and regulations.

Sincerely,

Thomas W. Chapple

Thomas W. Chapple
Environmental Engineer III

Attachment

cc: Michael Johnston - EPA, Seattle
Doug Lowery - NRO, Fairbanks

(e) The reverse rollback technique presented on pages 6-7 and 6-8 for predicting maximum ozone generation rates is inconsistent with previously submitted reports. This assessment identifies 62 ug/m^3 of ozone as the ozone generated by existing facilities. This value is derived from the difference between the maximum observed ozone at Prudhoe Bay (113 ug/m^3) less the average annual background level of ozone (51 ug/m^3). Pages 51 through 60 of the Air Quality and Meterorological Monitoring Study at Prudhoe Bay, Alaska, April 1,1979 - March 31, 1980, Final Report January, 1981, submitted to the Prudhoe Bay Unit Operators by Radian Corporation discusses in depth some well justified theories supporting the periodic occurance of "natural" ozone concentrations significantly above the average background level. This phenomena has been witnessed in other areas of Alaska during the spring months. None of the postulations presented in the monitoring report recognize the existing facilities as ozone generators because of their hydrocarbon emissions.

(f) The discussion of annual nitrogen dioxide impacts in Section 6.3.1 has the following deficiencies:

(i) The ozone limiting method for projecting annual nitrogen dioxide concentrations is a technique contained in the proposed revisions to the Guidelines on Air Quality Models. At this time, this is an unacceptable technique for the reasons stated in (d).

(ii) On page 6-12, the values of (0.10) (131.5) appears in the equation for the maximum annual NO_2 concentration. These values are presented for the first time without any narrative or graphic support to explain the manner in which they were derived.

(iii) On page 6-12 the statement is made that the maximum estimated contribution to ozone levels from the existing sources is 0 ug/m^3 (annual value), although, on page 6-8 in the one-hour ozone calculation, it is stated that a maximum one-hour concentration of ozone from existing facilities is estimated to be 62 ug/m^3. This appears to be an inconsistency, even when considering the differences in exposure times for which the calculations are performed.

(g) Table 4-1 of the technical note denotes the annual background concentration of nitrogen dioxide as 2 ug/m^3. The PSD-IV report on page 6-12 and Table 6-2, however, specify the background concentation as 4 ug/m^3. This is not a considerable difference, although, consistency should be maintained.

(h) The report contains no maps or graphic aids to illustrate projected ambient air pollutant isopleths in relation to the location of all stationary emissions sources in the Prudhoe Bay area. The technical note does provide this graphic information on annual NO_2 exposures; however, this is desirable for other pollutants and appropriate exposure times.

STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

DEPT. OF ENVIRONMENTAL CONSERVATION

465-2666

POUCH O — JUNEAU 99811

July 14, 1981

Mr. D. F. Dias
Environmental Engineer
Sohio Petroleum Company
Pouch 6-612
Anchorage, Alaska 99502

Dear Del:

This letter is to inform you of the Department's comments concerning the document entitled PSD Permit Application for New Sources to be Added to Existing and Previously Permitted Facilities in the Prudhoe Bay Unit (PSD-IV). As discussed in our meeting of April 16, 1981, several major concerns exist with the subject document which have been itemized in the attached document. The supplemental technical note entitled Air Quality Impacts of the Prudhoe Bay Unit PSD IV Sources as Estimated by the Texas Climatological Model (TCM-1), which you have provided as a result of our April meeting, has clarified several major concerns regarding the most likely ambient nitrogen dioxide impacts of these proposed facilities. However, it must be recognized that the technical note does not officially alter the PSD application.

For purposes of acquiring the necessary State permit, the following information must be submitted to the Department:

1. A request for a State permit or amendments to existing permits on a signed application form that refers to the equipment at each location.

2. Additional information regarding the use of Best Available Control Technology for the gas turbines to be installed for this project. Please see the appropriate comments in the attached document.

3. An indication that all proposed emissions sources will comply with all applicable state air quality standards and regulations.

Sincerely,

Thomas W. Chapple

Thomas W. Chapple
Environmental Engineer III

Attachment

cc: Michael Johnston - EPA, Seattle
Doug Lowery - NRO, Fairbanks

REVIEW OF APPLICATION

FOR

PREVENTION OF SIGNIFICANT DETERIORATION PERMIT

SOHIO-ARCO NORTH SLOPE PROJECT
SUBMITTED
30 JANUARY 1981

The Alaska Department of Environmental Conservation's Air quality section has reviewed the document entitled PSD Permit Application for New Sources to be Added to Existing and Previously Permitted Facilities in the Prudhoe Bay Unit (PSD-IV), received February 11, 1981. Upon initial review of the document, some major inadequacies were identified which were discussed with the applicant during an April 16, 1981, meeting held in Juneau. Principal inadequacieis are due the selection and use of an unapproved air quality dispersion model which generated results significantly different from prvious models of air quality in the Prudhoe Bay area. A technical note entitled Air Quality Impacts of the Prudhoe Bay Unit PSD IV Sources as Estimated by the Texas Climatological Model (TCM-1) was submitted by the applicant to the department June 1, 1981.

Review of the supplemental technical note indicates that annual ambient nitrogen dioxide impacts of this proposed project estimated by the EPA-approved TCM model are not appreciably greater than the impacts of all currently existing and permitted facilities. Although this supplemental document has clarified several major concerns of this Department, the official application for a Federal Prevention of Significant Deterioration permit remains unchanged. The following itemization identifies the deficiencies and inconsistencies in the original application.

(a) On page 3-6, the acronym "VOC" is used for non-volatile organic carbon. VOC is usally used to designate volatile organic compounds. Which meaning is desired? As presented in Table 3.3.2-1 of AP-42, the report test should indicate that only 5 to 10% of the total hydrocarbons from a gas turbine exhaust is non-methane in chemical structure.

(b) A statement is needed to justify that the ambient air quality data as measured in 1979 is representative of the immediate year prior to submitting for this PSD permit (40 CFR 52.21 (n) (2)).

(c) Best Available Control Technology discussion as presented in Chapter 5 is inadequate. The text refers to discussions presented in the report entitled PSD Permit Application for the Prudhoe Bay Unit Waterflood Project dated 28 September 1979, submitted to this Department and the U. S. Environmental Protection Agency - Region X. This reference contains a very good discussion of BACT for gas turbines; however, recent technological developments and their applicability to Prudhoe Bay Unit operations need to be presented and discussed. Recent developments which should be presented include two staged combustion technology for gas turbines, recent NOx source test data for gas turbines located in areas of relatively low ambient temperatures and the commercial availability and costs (capital and O & M) of gas turbines which can be guaranteed to meet NOx emission rates of less than 150 parts per million without water injection.

(d) Chapter 6 of the report presents air quality impacts as estimated by the use of the Industrial Source Complex (ISC) model. This model is described in the Proposed Revisions to EPA's Guideline on Air Quality Models dated October 1980. Problems associated with the use of and the results projected by this model are identified below.

(i) Criteria for acceptable air quality models are specified in 40 CFR 52.21 (m) (1) for new sources to be constructed in areas classified for the Prevention of Significant Deterioration. The regulation states "All estimates of ambient concentrations required under this section shall be based on the applicable air quality models, data bases, and other requirements specified in the Guideline on Air Quality Models (OAQPS 1.2-080, U. S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N. C. 27711, April 1978). Paragraph (m) (2) of the same regulations stipulates that an applicant may utilize a modification of a current model or substitute a different model that may be more appropriate if the modification or model has been subject to public review and approved by the Administrator of the USEPA. These regulations clearly suggest that it is the applicant's responsibility to select a model best suited to the specific conditions which are to be modeled. However, because the ISC model is not contained in the 1978 Guideline on Air Quality Models nor have the 1980 proposed revisions to the guideline been appoved by the Administrator, use of the model at this time, is not acceptable for estimating air quality impacts of these proposed activities (FR 3-27-80, p. 20158).

(ii) Regardless of the status of this model's acceptance, the fundamental and optional algorithms of the ISC model must be compared with those of an approved model (ie. the Texas Climatological Model previously used for analyzing Prudhoe Bay projects) as outlined in the Workbook for Comparison of Air Quality Models, May 1978 (EPA - 450/2-78-028a).

(iii) Utilization of the building wake option of the ISC model for 100% of the time in predicting annual ambient exposures is certainly a conservative but probably not a valid assumption for simulating actual field conditions. It may however be applicable and very informative for projecting ambient impacts where exposure times times are 24 hours or less (ie. 24 hr. TSP, 3 hr. and 8 hr. SO_2) or possibly identifying physical locations which may exhibit high nitrogen dioxide concentrations for short exposure times. If the short-term nitrogen dioxide concentrations are found to be sufficiently high (say, 5 to 10 times the annual standard) because of stack downwash, then it would be warranted to investigate through the annual meterological data the relative frequency of this occurrence.

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
SEATTLE, WASHINGTON 98101

NOTICE OF APPLICATION TO CONSTRUCT AND PRELIMINARY DETERMINATION ATLANTIC RICHFIELD COMPANY/SOHIO PETROLEUM COMPANY

Notice is hereby given that the Atlantic Richfield Company and the SOHIO Petroleum Company (ARCO/SOHIO) have filed with the Environmental Protection Agency (EPA) an application to install additional gas-fired turbines and heaters at the Prudhoe Bay Oil Field pursuant to EPA's regulation for prevention of significant air quality deterioration (the Clean Air Act as amended August 7, 1977). EPA regulations require the pre-construction review and approval of certain categories of new or modified industrial sources of air pollution to assure that a proposed source's emissions will not cause a violation of air quality deterioration limits.

Notice is also given pursuant to Section 52.21(m)(2) of the PSD regulations that the PSD application contains an air quality impact analysis done using a model not found in "Guidelines on Air Quality Models" (EPA 450-2-78-027). The model (ISC), was used to predict nitrogen oxides, sulfur dioxide and total suspended particulate impacts due to facility construction. EPA consents to use of the ISC model because the "Guidelines" contain no models appropriate for use in the Prudhoe Bay situation.

The proposed turbines and heaters are needed to support the previously approved Produced Water Injection/Low Pressure Separation/Artificial Lift and Waterflood projects.

PRELIMINARY DETERMINATION

EPA has completed a preliminary analysis of the information submitted by ARCO/SOHIO and has tentatively determined that the modifications to the plant operation will not cause significant deterioration of air quality and will employ best available control technology (BACT) to minimize emissions. EPA therefore, proposes to issue a Notice of Approval to modify the Prudhoe Bay Oil Field Facilities.

PUBLIC COMMENT

An analysis document supporting this preliminary determination has been prepared by EPA and is available for review at:

EPA, Region X
Regional Library, 12th Floor
1200 Sixth Avenue
Seattle, Washington 98101

This document, together with the information submitted by the applicant, will also be available for public inspection at the following locations:

EPA, Alaska Operations Office
701 'C' Street
Federal Building, Room E535
Anchorage, Alaska 98501

State of Alaska
Department of Environmental Conservation
Office of Air Programs
Juneau, Alaska 99811

Fairbanks North Star Borough Regional Library
1215 Cowles
Fairbanks, Alaska

Z-J Loussac Library
427 F
Anchorage, Alaska

Interested persons are invited to submit for EPA's consideration written comments concerning the proposed project approval. A public hearing can be conducted to discuss the project if requested in writing during the first fourteen (14) days of the public comment period. Comments and requests for public hearing should be sent to the Regional Administrator, EPA, Region 10, 1200 Sixth Avenue, Seattle, Washington 98101; Attention: Mr. Michael Johnston. Written comments will be accepted for a period of 30 calendar days from the date of publication of this notice and will be made available for inspection at the above listed locations. To be most effective, comments should address air quality considerations and include support materials where available.

A copy of EPA's final determination regarding the proposed source (to be completed after close of the comment period) will be filed for inspection at the above listed locations.

for L. Edwin Coate
Donald P. Dubois

8 JUL 1981

To be Published

M/S 521

1 JUL 1981

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. G. N. Nelson
SOHIO Petroleum Company
Pouch 6-612
Anchorage, Alaska 99502

Dear Mr. Nelson:

As you know, the federal requirements for the Prevention of Significant Air Quality Deterioration (PSD) state that EPA must make a preliminary determination on the approvability of any major proposed construction and provide an opportunity for public comment on that determination. In addition, the Clean Air Act requires that if an air quality model not listed in the EPA Guideline on Air Quality Models is used in the PSD permit application, the same opportunity for public comment must be afforded before the non-guideline model can be accepted.

Enclosed, for your information, is a copy of EPA's preliminary determination analysis document on the Atlantic Richfield Company/SOHIO Petroleum Company (ARCO/SOHIO) application for approval to modify the oil field facilities at Prudhoe Bay, Alaska. Also enclosed is a copy of the notice which we expect will be published in the Fairbanks "News Miner" and the Anchorage "Times" on . The notice briefly outlines EPA's preliminary determination and lists locations where the application for modification and the preliminary determination document may be reviewed.

Following publication of the notice, written public comments will be accepted by EPA for 30 days. A copy of all comments received will be forwarded to you immediately and will also be made available to the public at the locations listed in the notice. Additonally, a public hearing may be requested. A summary of comments made will be provided to you as soon as possible after a hearing. You may make a written response to EPA concerning any public comments made.

We will complete our final action on your application as quickly as possible after the close of the public comment period. A copy of the final determination document will be sent to you and will also be made available at the locations listed in the notice.

P07 3853073

RECEIPT FOR CERTIFIED MAIL

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G.N. Nelson

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☆ U.S. GOVERNMENT PRINTING OFFICE 1978: 269-897

If you have any questions concerning the preliminary determination document, please call Michael Johnston of my staff at (206) 442-7176.

Sincerely,

/s/ L. Edwin Coate

Donald P. Dubois
Regional Administrator

Enclosures

cc: P. B. Norgaard, ARCO
W. P. Metz, ARCO
D. F. Dias, SOHIO

CADAMS:jb:6-19-81(#1017N) CONCURRENCES

SYMBOL	RCN							
SURNAME	NYE	JOHNSTON	GEREN	REED	COATE			
DATE	9/16/81	6/26	6/26					

EPA Form 1320-1 (12-70) OFFICIAL FILE COPY

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
SEATTLE, WASHINGTON 98101

NOTICE OF APPLICATION TO CONSTRUCT AND PRELIMINARY DETERMINATION ATLANTIC RICHFIELD COMPANY/SOHIO PETROLEUM COMPANY

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Notice is also given pursuant to Section 52.21(m)(2) of the PSD regulations that the PSD application contains an air quality impact analysis done using a model not found in "Guidelines on Air Quality Models" (EPA 450-2-78-027). The model (ISC), was used to predict nitrogen oxides, sulfur dioxide and total suspended particulate impacts due to facility construction. EPA consents to use of the ISC model because the "Guidelines" contain no models appropriate for use in the Prudhoe Bay situation.

The proposed turbines and heaters are needed to support the previously approved Produced Water Injection/Low Pressure Separation/Artificial Lift and Waterflood projects.

PRELIMINARY DETERMINATION

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Federal Building, Room E535
Anchorage, Alaska 98501

State of Alaska
Department of Environmental Conservation
Office of Air Programs
Juneau, Alaska 99811

Fairbanks North Star Borough Regional Library
1215 Cowles
Fairbanks, Alaska

Z-J Loussac Library
427 F
Anchorage, Alaska

Interested persons are invited to submit for EPA's consideration written comments concerning the proposed project approval. A public hearing can be conducted to discuss the project if requested in writing during the first fourteen (14) days of the public comment period. Comments and requests for public hearing should be sent to the Regional Administrator, EPA, Region 10, 1200 Sixth Avenue, Seattle, Washington 98101; Attention: Mr. Michael Johnston. Written comments will be accepted for a period of 30 calendar days from the date of publication of this notice and will be made available for inspection at the above listed locations. To be most effective, comments should address air quality considerations and include support materials where available.

A copy of EPA's final determination regarding the proposed source (to be completed after close of the comment period) will be filed for inspection at the above listed locations.

/s/ L. Edwin Coate

Donald P. Dubois

8 JUL 1981

To be Published

CONCURRENCES

SYMBOL	ADAMS:jb:6-19-81(#1015N)					
SURNAME	NYE	JOHNSTON	GEREN	REED	COATE	
DATE	6/19/81		6/26			

EPA Form 1320-1 (12-70)

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M/S 521

1 JUL 1981

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. P. B. Norgaard
Atlantic Richfield Company
P. O. Box 360
Anchorage, Alaska 99570

Dear Mr. Norgaard:

As you know, the federal requirements for the Prevention of Significant Air Quality Deterioration (PSD) state that EPA must make a preliminary determination on the approvability of any major proposed construction and provide an opportunity for public comment on that determination. In addition, the Clean Air Act requires that if an air quality model not listed in the EPA Guideline on Air Quality Models is used in the PSD permit application, the same opportunity for public comment must be afforded before the non-guideline model can be accepted.

Enclosed, for your information, is a copy of EPA's preliminary determination analysis document on the Atlantic Richfield Company/SOHIO Petroleum Company (ARCO/SOHIO) application for approval to modify the oil field facilities at Prudhoe Bay, Alaska. Also enclosed is a copy of the notice which we expect will be published in the Fairbanks "News Miner" and the Anchorage "Times" on . The notice briefly outlines EPA's preliminary determination and lists locations where the application for modification and the preliminary determination document may be reviewed.

Following publication of the notice, written public comments will be accepted by EPA for 30 days. A copy of all comments received will be forwarded to you immediately and will also be made available to the public at the locations listed in the notice. Additonally, a public hearing may be requested. A summary of comments made will be provided to you as soon as possible after a hearing. You may make a written response to EPA concerning any public comments made.

We will complete our final action on your application as quickly as possible after the close of the public comment period. A copy of the final determination document will be sent to you and will also be made available at the locations listed in the notice.

P07 3853074

RECEIPT FOR CERTIFIED MAIL

NO INSURANCE COVERAGE PROVIDED—
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SENT TO
P. B. Norgaard

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PS Form 3800, Apr. 1976

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4. If you want delivery restricted to the addressee, or to an authorized agent of the addressee, endorse RESTRICTED DELIVERY on the front of the article.
5. Enter fees for the services requested in the appropriate spaces on the front of this receipt. If return receipt is requested, check the applicable blocks in Item 1 of Form 3811.
6. Save this receipt and present it if you make inquiry.

☆U.S. GOVERNMENT PRINTING OFFICE 1978: 269-897

If you have any questions concerning the preliminary determination document, please call Michael Johnston of my staff at (206) 442-7176.

Sincerely,

/s/ L. Edwin Coate

Donald P. Dubois
Regional Administrator

Enclosures

cc: G. N. Nelson, SOHIO
D. F. Dias, SOHIO
W. P. Metz, ARCO

CADAMS:jb:6-19-81(#1017N) CONCURRENCES

SYMBOL								
SURNAME	NYE	JOHNSTON	GEREN	REED	COATE			
DATE		6/26	6/29					

If you have any questions concerning the preliminary determination document, please call Michael Johnston of my staff at (206) 442-7176.

Sincerely,

/s/ L. Edwin Coate

Donald P. Dubois
Regional Administrator

Enclosures

cc: G. N. Nelson, SOHIO
D. F. Dias, SOHIO
W. P. Metz, ARCO

	CADAMS:jb:6-19-81(#1017N)		CONCURRENCES				
SYMBOL							
SURNAME	NYE	JOHNSTON	GEREN	REED	COATE		
DATE		6/26	6/26				

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE:

SUBJECT: ACTION MEMORANDUM - Notice of Application to Construct and Preliminary Determination, Atlantic Richfield Company and SOHIO Petroleum Company (ARCO/SOHIO) at Prudhoe Bay, Alaska

FROM: Lloyd A. Reed, Director
for Enforcement Division (M/S 517)

TO: Donald P. Dubois
Regional Administrator (M/S 601)

Discussion

On April 2, 1981, EPA received from ARCO/SOHIO a complete PSD application requesting approval to modify the existing oil field facilities at Prudhoe Bay, Alaska by the installation of additional gas-fired turbines and heaters. The project is subject to PSD review for emissions of nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2) and particulate matter (PM).

One point you should be made aware of is that the turbine performance limitation for NO_x proposed by ARCO/SOHIO is not as stringent as our technical staff found to be reasonably achievable. Information available from vendors and source tests from recently installed gas turbines show that with dry controls, gas turbines can be expected to achieve NO_x emissions of less than 100 ppm at 15% O_2 compared to 150 ppm proposed by the Company.

Another potential issue is that the Industrial Source Complex (ISC) model, which is not yet officially considered a guideline model, was used for the air quality analysis in the technical review. While not listed in EPA's "Guideline on Air Quality Models", the ISC model is included in the Proposed Revisions to these guidelines which EPA published in October 1980. The ISC model was judged most suitable for this application as it is the only model which accounts for building-wake-induced downwash of pollutants, a potential problem at this facility.

Recommendation

The emission limits indicated in the preliminary determination reflect BACT. Construction of the project will not cause violation of the National Ambient Air Quality Standards or PSD air quality increments. The staff recommendation is that you sign the enclosed letters to Mr. Norgaard and Mr. Nelson, the Notice of Application to Construct and the Preliminary Determination Document.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

ACTION MEMORANDUM - Notice of Application to Construct and Preliminary Determination, Atlantic Richfield Company and SOHIO Petroleum Company (ARCO/SOHIO) at Prudhoe Bay, Alaska

Lloyd A. Reed, Director
Enforcement Division (M/S 517)

Donald P. Dubois
Regional Administrator (M/S 601)

Discussion

On April 2, 1981, EPA received from ARCO/SOHIO a complete PSD application requesting approval to modify the existing oil field facilities at Prudhoe Bay, Alaska by the installation of additional gas-fired turbines and heaters. The project is subject to PSD review for emissions of nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2) and particulate matter (PM).

One point you should be made aware of is that the turbine performance limitation for NO_x proposed by ARCO/SOHIO is not as stringent as our technical staff found to be reasonably achievable. Information available from vendors and source tests from recently installed gas turbines show that with dry controls, gas turbines can be expected to achieve NO_x emissions of less than 100 ppm at 15% O_2 compared to 150 ppm proposed by the Company.

Another potential issue is that the Industrial Source Complex (ISC) model, which is not yet officially considered a guideline model, was used for the air quality analysis in the technical review. While not listed in EPA's "Guideline on Air Quality Models", the ISC model is included in the Proposed Revisions to these guidelines which EPA published in October 1980. The ISC model was judged most suitable for this application as it is the only model which accounts for building-wake-induced downwash of pollutants, a potential problem at this facility.

Recommendation

The emission limits indicated in the preliminary determination reflect BACT. Construction of the project will not cause violation of the National Ambient Air Quality Standards or PSD air quality increments. The staff recommendation is that you sign the enclosed letters to Mr. Norgaard and Mr. Nelson, the Notice of Application to Construct and the Preliminary Determination Document.

Chron	CADAMS:jb:6-19-81(#1018N)		CONCURRENCES					
SYMBOL								
SURNAME	NYE	JOHNSTON	GEREN					
DATE	6/19/81		6/26					

EPA Form 1320-1 (12-70) OFFICIAL FILE COPY

PRELIMINARY DETERMINATION DOCUMENT
PREVENTION OF SIGNIFICANT AIR QUALITY DETERIORATION
PROPOSED MODIFICATION OF THE PRUDHOE BAY OIL FIELD AT
PRUDHOE BAY, ALASKA

SCOPE

This document, with the technical analysis, presents EPA's preliminary determination of approvability of the Atlantic Richfield Company/SOHIO Petroleum Company (ARCO/SOHIO) proposal to modify the production facilities at the Prudhoe Bay Oil Field at Prudhoe Bay, Alaska under Title 1, Part C of the Federal Clean Air Act, "Prevention of Significant Deterioration of Air Quality" (PSD).

GENERAL INFORMATION

The Federal Clean Air Act requires review and approval of the construction or modification of major sources of air pollution to assure that the air quality in areas attaining National Ambient Air Quality Standards (NAAQS) is not deteriorated beyond allowable limits for any pollutants regulated by EPA as a result of increased emissions from such new or modified facilities.

Before an application to construct or modify a major stationary source can be approved, it must be demonstrated that the expected emissions of all regulated pollutants above the minimum level established by Section 169 of the Act will not exceed the following:

1. Emission limits achievable by the application of best available control technology (BACT).

2. National Ambient Air Quality Standards (NAAQS).

3. In the case of particulate matter (TSP) and sulfur dioxide (SO_2), allowable air quality increments.

FINDINGS

ARCO/SOHIO proposes to modify the existing facilities in the Prudhoe Bay Oil Field by installing various turbines and heaters which will supplement those already approved and permitted there by EPA. The total rated capacity of the additional equipment is approximately 303 million horsepower (HP) for the turbines and 250 million BTU/hr for the heaters. All turbines and heaters will be fired by natural gas. The need for the proposed modification was recognized as engineering designs for the three previously permitted projects showed future shortfalls in turbine and heater capacity. The project is subject to review under the PSD requirements for nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM) and sulfur dioxide (SO_2). The proposed emission limitations for these pollutants are listed in the table below.

EMISSION LIMITATIONS

Equipment	Pollutant	Tons/Year	Performance Limit
Gas Turbines	NO_x	5,397	100 (14.4/Y) ppm*
	CO	1,460	109 lb/10^6 scf of fuel used
	PM	198	10% opacity
	SO_2	48	
Process Heaters	NO_x	88	0.08 lb/10^6 BTU
	CO	21	0.018 lb/10^6 BTU
	PM	12	
	SO_2	4	

*NO_x emission factor for gas-fired turbines is modified by an efficiency factor (Y = manufacturer's rated heat rate at rated peak load) which cannot exceed 14.4 kilojoules/watt-hour. Based at 15% oxygen on a dry basis.

The Companies proposal was to use dry (internal combustion) controls to limit NO_x emissions from the turbines to the NSPS value of 150 ppm at 15% O_2. Information available from vendors and source tests on similar, recently installed turbines indicate that 100 ppm is reasonably achievable and, therefore, is established as BACT for this project. Otherwise, performance limitations for the turbines can be met by burning natural gas and using good operating and maintenance procedures to achieve proper combustion conditions. For the heaters, performance limitations can be achieved by limiting the H_2S concentration of the fuel gas and using low NO_x burners.

A detailed discussion of this determination as well as proposed record keeping requirements are contained in the Technical Analysis document.

An ambient air quality analysis demonstrates that emissions of NO_x, CO, SO_2 and PM, as limited above, are not expected to cause or contribute to a violation of any NAAQS or PSD air quality increment. There are no PSD increments for the NO_x and CO pollutants. The technical analysis document also identifies the specific impact of the proposal on the appropriate standards.

RECOMMENDATION

Based upon a review of the application, EPA finds that the proposed modification will not cause violations of any NAAQS or PSD air quality increments. The emission limits required above for NO_x, CO, SO_2 and PM represent the best available control technology. Therefore, EPA proposes to approve ARCO/SOHIO's request to add gas-fired turbines and heaters to the oil field complex at Prudhoe Bay, Alaska. Comments are requested from interested parties and will be carefully considered when the final determination is made.

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3. In the case of particulate matter (TSP) and sulfur dioxide (SO_2), allowable air quality increments.

FINDINGS

ARCO/SOHIO proposes to modify the existing facilities in the Prudhoe Bay Oil Field by installing various turbines and heaters which will supplement those already approved and permitted there by EPA. The total rated capacity of the additional equipment is approximately 303 million horsepower (HP) for the turbines and 250 million BTU/hr for the heaters. All turbines and heaters will be fired by natural gas. The need for the proposed modification was recognized as engineering designs for the three previously permitted projects showed future shortfalls in turbine and heater capacity. The project is subject to review under the PSD requirements for nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM) and sulfur dioxide (SO_2). The proposed emission limitations for these pollutants are listed in the table below.

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The Companies proposal was to use dry (internal combustion) controls to limit NO_x emissions from the turbines to the NSPS value of 150 ppm at 15% O_2. Information available from vendors and source tests on similar, recently installed turbines indicate that 100 ppm is reasonably achievable and, therefore, is established as BACT for this project. Otherwise, performance limitations for the turbines can be met by burning natural gas and using good operating and maintenance procedures to achieve proper combustion conditions. For the heaters, performance limitations can be achieved by limiting the H_2S concentration of the fuel gas and using low NO_x burners.

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RECOMMENDATION

Based upon a review of the application, EPA finds that the proposed modification will not cause violations of any NAAQS or PSD air quality increments. The emission limits required above for NO_x, CO, SO_2 and PM represent the best available control technology. Therefore, EPA proposes to approve ARCO/SOHIO's request to add gas-fired turbines and heaters to the oil field complex at Prudhoe Bay, Alaska. Comments are requested from interested parties and will be carefully considered when the final determination is made.

CONCURRENCES

SYMBOL							
SURNAME	CADAMS:fb:6-19-81(#1019N)						
DATE							
	NYE	JOHNSTON	GEREN	REED	COATE	DUBOIS	

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: MAY 22 1981

SUBJECT: PSD Technical Analysis--ARCO/SOHIO--Prudhoe Bay, Alaska

FROM: Robert G. Courson, Chief
Technical Support Branch (M/S 329)

RECEIVED
MAY 26 1981
PERMITS BRANCH
EPA - REGION 10

TO: Harold Geren, Chief
Permits Branch (M/S 521

Attached is a copy of our Technical Analysis for Prevention of Significant Deterioration for the PSD IV sources proposed by ARCO/SOHIO at Prudhoe Bay, Alaska.

Most of the results of the air quality analysis for this technical review were based on the Industrial Source Complex (ISC) Model. The ISC Model is technically a non-guideline model. The model was judged to be the most appropriate model available for this air quality analysis. For this reason, the model was used in this air quality review and public comments concerning the use of the model should be invited. No other issues arose in the air quality analysis or BACT review.

If you have any questions concerning the air quality analysis contact Bill Puckett or concerning BACT, contact Dave Tetta.

Attachment

Technical Analysis for
Prevention of Significant Deterioration
ARCO/SOHIO - Prudhoe Bay, Alaska
May 20, 1981

I. Introduction

The SOHIO Alaska Petroleum Company and ARCO Alaska, Incorporated, on behalf of the Prudhoe Bay Unit Owners, propose to construct additional facilities at the Prudhoe Bay oil field. These facilities will supplement those described in the consortium's earlier PSD applications. The new units consist of heaters (the precise number was not given by the applicant) with a combined heat input rate of 250 million BTU's per hour, and a number of turbines (the precise number was not given by the applicants) with a combined capacity of 303 thousand horsepower. A breakdown of the proposed additions is presented in Table 1.

The projected emissions increase, in tons per year, from the project are summarized below:

Pollutant	Emissions	EPA Significant Emissions Level
NO_x	8,305	40
PM	210	25
CO	1,481	100
SO_2	52	40
VOC	27	40

As shown in the above table, projected emissions of NO_x, PM, CO, and SO_2 are above the significant emissions levels for modified sources as defined in §52.21(b)(23)(i) of the PSD regulations. Therefore, a BACT determination and air quality analysis will be required for NO_x, PM, CO, and SO_2.

II. Determination of Best Available Control Technology (BACT)

Definition

BACT defines an emission limitation based on the maximum degree of reduction achievable through application of process modifications and emission control systems. BACT is determined on a case-by-case basis taking into account energy, economic, and environmental impacts. BACT emission limits must not exceed New Source Performance Standards (NSPS) proposed or promulgated under 40 CFR Part 60.

Table 1

Equipment List for Proposed Modification

Location	Description
GC-1	2-7.5 MHP Turbines
GC-1	35 MHP Turbine Capacity
GC-2	3-7.5 MHP Turbines
GC-2	45 MHP Turbine Capacity
GC-3	1-7.5 MHP Turbines
GC-3	60 MHP Turbine Capacity
West Injection Plan	25 MHP Turbine Capacity
FS-1	1-5 MHP Turbine
FS-1	125 MMBTU/hr Heater Capacity
FS-1	36 MHP Turbine Capacity
FS-2	2-5 MHP Turbines
FS-3	2-5 MHP Turbines
FS-3	125 MMBTU/hr Heater Capacity
Seawater Treatment Plant	8-4 MHP Turbines

BACT for the Turbines

NO_x and CO

Standards of Performance for Stationary Gas Turbines were promulgated on September 10, 1979 for NO_x. These standards limit NO_x emissions from turbines used for oil or gas transportation and production to 150 ppm at 15% oxygen on a dry basis. The NO_x emission limit for gas turbines is modified by a turbine efficiency factor, and the source test results must by adjusted to (ISO) standard day conditions.

The two best systems available for reduction of NO_x from combustion turbines are dry (internal combustion) controls and injection of water or steam. Dry controls are incorporated into the design of the turbine combustion chamber by the manufacturer. Water or steam injection lowers the peak combustion temperature in the turbine and therefore reduces the amount of NO_x formed. NO_x emissions of less than 75 ppm at 15% oxygen can be achieved with water or steam injection.

Water or steam injection to limit NO_x emissions is infeasible at the Prudhoe Bay operation primarily because of its geographic location. Alaska's north slope has a shortage of fresh water, a fragile environment, and is extremely cold during much of the year. Water injection requires large quantities of high quality water. Although large amounts of water will be required for the operation of the Waterflood expansion project, it will not be of the quality necessary for injection into turbines. Seawater will be given primary treatment basically to remove excess oxygen and suspended solids before its use in well injection to maintain oil reservoir pressure. Fresh water must be used for turbine injection and requires carefully monitored pH and extremely low minerals and dissolved and suspended solids contents. The cost for facilities to produce water of this quality would be prohibitive for the Prudhoe Bay Unit Owners. In addition, the available fresh water in this region is often frozen and contains a relatively high concentration of dissolved solids and related impurities. Alaska also has strict laws regulating commercial water use in order to protect fish and wildlife. These problems would have to be overcome before water injection could be considered. The cost to the Prudhoe Bay unit owners would be much greater than that typical for the "lower 48" due to the required storage of water for use during low flow periods, installation of water treatment facilities, and increased energy costs to keep the water from freezing during cold periods.

Dry controls can reasonably be expected to limit NO_x emissions to the NSPS value of 150 ppm at 15% O_2. There is some evidence indicating that even lower levels are achievable using dry controls. One manufacturer plans to guarantee a NO_x emission level of less than 100 ppm using dry controls for turbines greater than 40 MHP. The turbine at Alyeska pump station #2 was source tested in 1980 and found to emit about 50 ppm NO_x. A number of the gas turbines at Prudhoe Bay have been tested for NO_x emissions. The test results showed NO_x emissions of 40-80 ppm. Based on this evidence, an emission level of 100 ppm is now considered BACT.

Incomplete combustion is the primary cause of carbon monoxide (CO) emissions from stationary gas turbines. CO emissions can best be reduced by maintaining proper combustion conditions by regulating fuel to air ratios, mixing, and combustion temperatures. Since documented evidence is unavailable to indicate that better control is available for CO emissions, the emission limitation based upon natural gas as the fuel and representative of BACT for CO is calculated to be 109 lb/10^6 scf of fuel used. This limit is consistent with the level of control defined as BACT in the previous Waterflood PSD application.

PM and SO_2

No effective controls have been demonstrated for reducing PM emission from gas turbines. Therefore, a level of emissions equal to that specified in the AP-42 emission factors is judged to represent BACT. For 303 MHP of turbine capacity, this level corresponds to PM emissions of 198 tons per year.

The company proposes to control SO_2 emissions from the turbines by limiting the H_2S concentration of the fuel gas to 20 ppm. This will result in an outlet concentration well below the NSPS limit for gas turbines of 150 ppm. Therefore, this level of SO_2 control is considered BACT. This corresponds to annual SO_2 emissions of 48 tons per year.

BACT for the Process Heaters

NO_x and CO

For the process heaters, BACT must be determined for NO_x and CO. NSPS regulations for process heaters have not been proposed or promulgated as of this time, however, the NSPS for fossil fuel fired steam generators will be used for comparison. These regulations include an NO_x emission limit for gas-fired units of 0.20 lb NO_x/10^6 BTU and a 25% reduction from potential emissions for fossil fuel fired steam generators with a capacity greater than 250 x 10^6 BTU/hr. Although none of the nine proposed heating units have a capacity greater than 250 x 10^6 BTU/hr, this NSPS will be used as a comparison in the analysis that follows.

The company proposed to limit NO_x by burning natural gas. Other NO_x reduction processes such as off-stoichiometric combustion, minimizing excess air to the combustion process, and flue gas recirculation were considered but rejected either because of the remoteness of the source or the relatively small size of the process heaters.

Low NO_x burners reduce NO_x emissions by improved fuel-air mixing, lower peak flame temperatures, oxygen deficient combustion, and flue gas recirculation. These burners have been shown to reduce emissions to the range of 40-75 ppm which represents a 60-75% reduction from the maximum AP-42 emission factor. These burners can reasonably be expected to reduce NO_x emissions to less than 70 ppm or 35 ng/J (.08 lb $NO_x/10^6$ BTU). The use of low NO_x burners on process heaters would result in a substantial decrease in emissions over natural gas firing alone. Low NO_x burners should not require dramatically increased upkeep over other types of burners; therefore, BACT for the process heaters will be set at .08 lb $NO_x/10^6$ BTU (35 ng/J).

CO from process heaters are minimized by burning gas rather than oil and by monitoring combustion parameters to maintain good combustion. Either oxygen or carbon monoxide levels in the combustion flue gas can be used as an indicator of good combustion; therefore, the installation of either continuous CO or O_2 monitors or the implementation of an acceptable periodic monitoring program will be required for all of the process heaters. CO or O_2 monitoring and gas firing will be considered BACT for the process heaters. The CO emission limit for the process heaters is based upon the use of natural gas as the fuel and is calculated to be 21 T/yr.

PM and SO_2

No effective controls have been demonstrated for PM emissions from process heaters. Therefore, a level of emission equal to that specified in the AP-42 emission factors is judged to represent BACT. For 250 MMBTU/hr of heater capacity, this level corresponds to PM emissions of 12 tons per year.

The company proposes to control SO_2 emissions from the heaters by limiting the H_2S content of the fuel gas to 20 ppm. No effective controls have been demonstrated for achieving lower SO_2 emission levels. Therefore, this level of control is considered BACT. This corresponds to annual emissions of 4 tons per year.

III. Ambient Air Quality Analysis

Based on the discussion in the previous section, the proposed ARCO/SOHIO additional sources will be subject to air quality review for carbon monoxide (CO), oxides of nitrogen (NO_x), sulfur dioxide (SO_2), and particulate matter (PM). The air quality analysis must

demonstrate that emissions of the above pollutants from the proposed additional sources will not cause or contribute to violations of any applicable National Ambient Air Quality Standards (NAAQS). The sum of volatile organic compounds (VOC) emissions from previously permitted, but not yet operational, sources and proposed sources is greater than 100 tons/year. For this reason, an ambient impact analysis must be conducted for ozone (O_3). In addition, it must be shown that the proposed new sources will not cause PSD increments for SO_2 or total suspended particulate (TSP) to be exceeded. The air quality analysis may also demonstrate that the maximum impacts from the proposed additional sources are below the EPA Levels of Significant Ambient Impact, in which case, no further analysis is necessary. The applicable NAAQS, PSD increments, and levels of significant ambient impact are listed in Table 3.

A. Existing Conditions

The proposed ARCO/SOHIO facilities will be co-located with previously permitted facilities. The exact locations of the proposed facilities are shown in the PSD application. The general project area lies within the Arctic Coastal Plain of Northwestern Alaska immediately to the south of Prudhoe Bay on the Beaufort Sea. Existing facilities are spread over an area of approximately 500 square kilometers. The project area is characterized by relatively flat terrain that gradually slopes downward to the coast of the Arctic Ocean. The elevation of the area averages about 15 meters above sea level.

Ambient air quality levels in the Prudhoe Bay area are currently in compliance with all federal and state ambient air quality standards. To determine existing and background air quality, a monitoring program was conducted in the Prudhoe Bay area from April 1, 1979 through March 31, 1980. Two air quality monitoring locations (Site 1 and Site 2) were used in the study and are shown in Figure 1. According to previous modeling results (discussed in the Technical Analysis Document for PSD Waterflood Expansion), these monitor locations are not representative of the areas of maximum air quality impact of existing sources. However, since wind roses characteristic of the Prudhoe Bay area show that the frequency distribution of wind direction is bimodal with an east-west orientation, these locations can be thought of as being essentially upwind or downwind of existing sources considering the prevailing wind direction. (A wind rose is defined as a diagram showing the distribution of wind direction experienced at a given location over a considerable period.) The wind rose for Site 1 is shown in Figure 2. The maximum values measured at Site 1 and Site 2, while not representative of maximum impacts, may be considered as representative of typical downwind impacts resulting from existing souces. In addition, when the wind direction is such

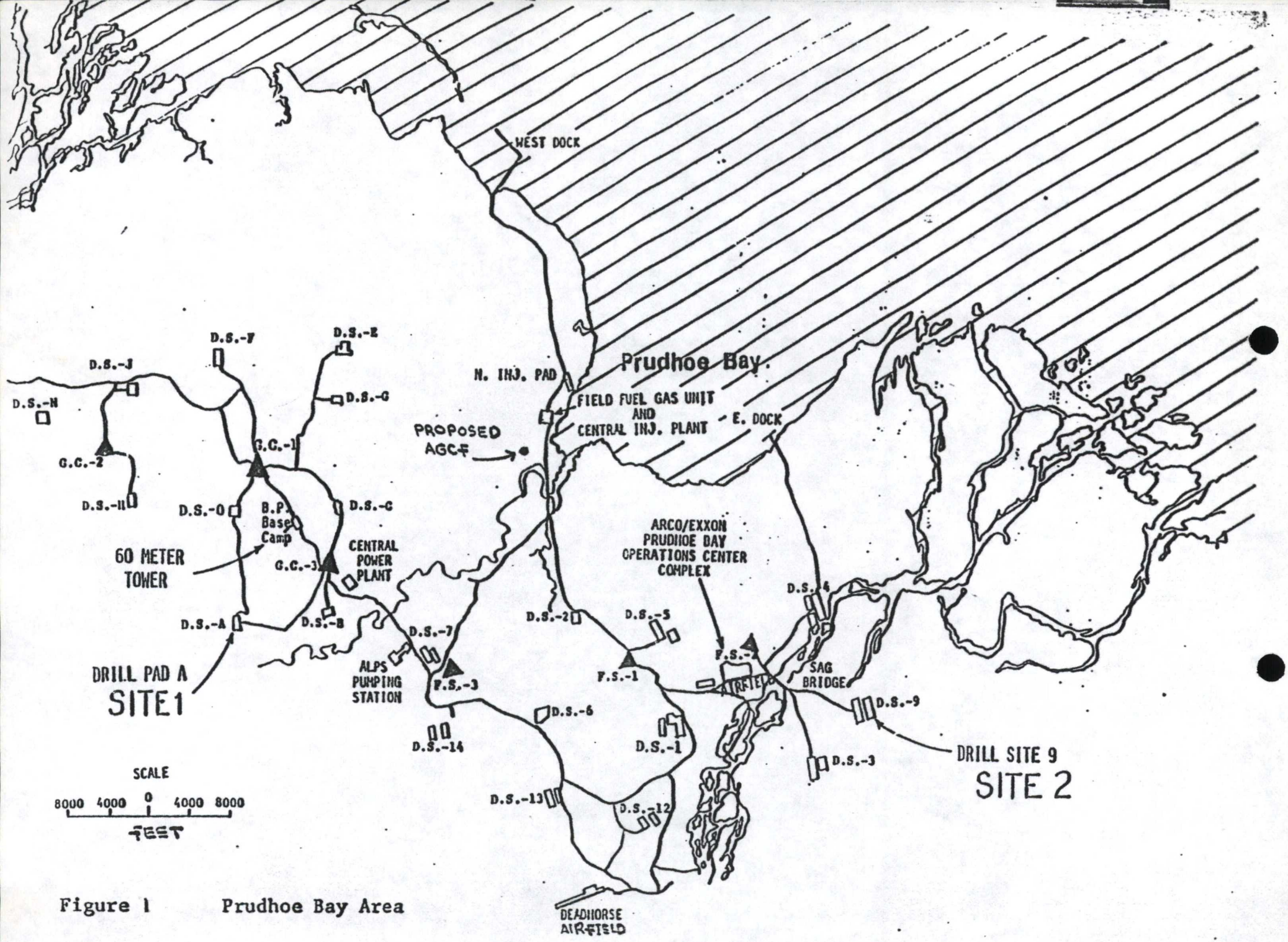
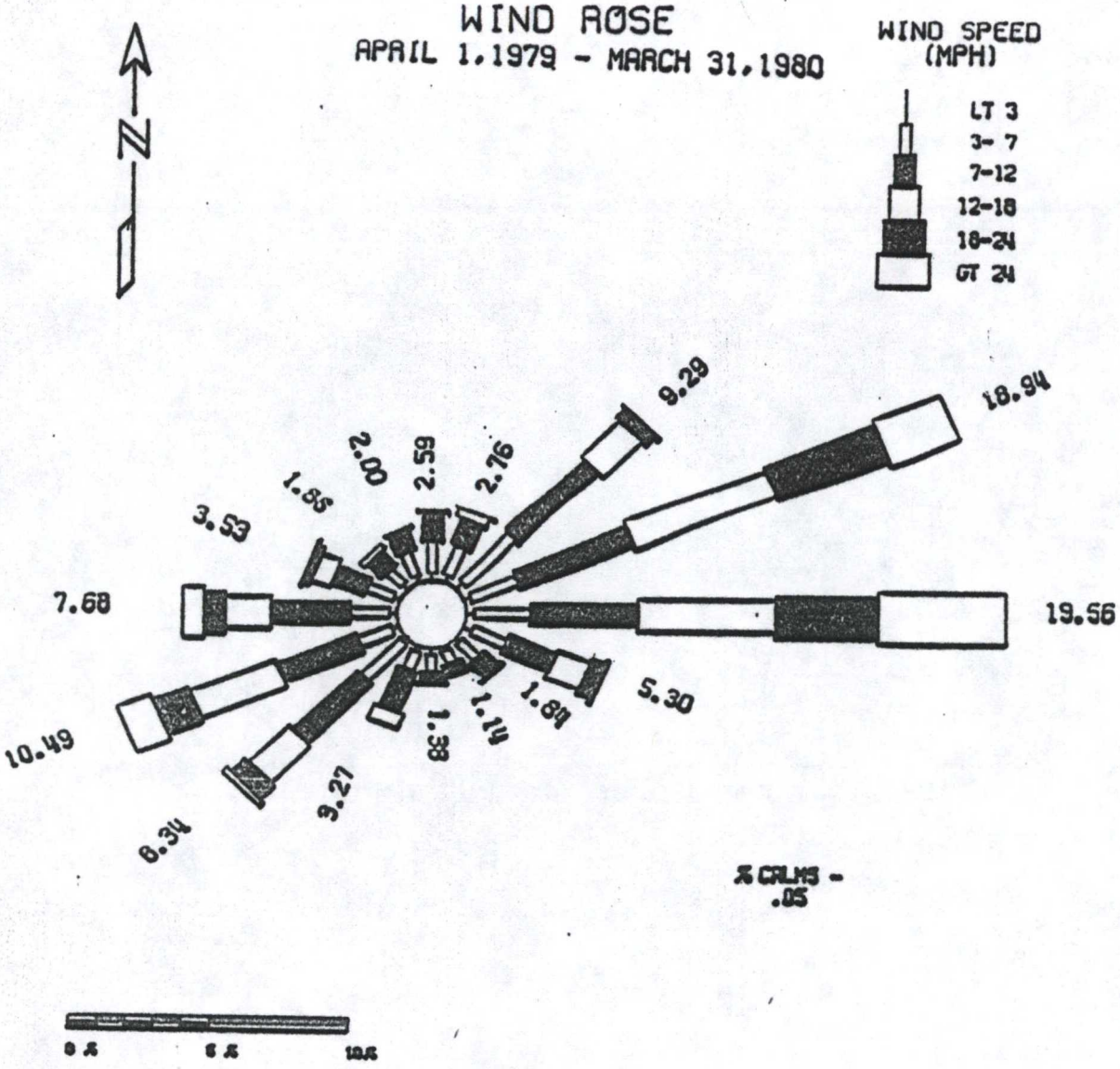


Figure 1 Prudhoe Bay Area

RADIAN
CORPORATION



PRUDHOE BAY - DRILL PAD A

Figure 2

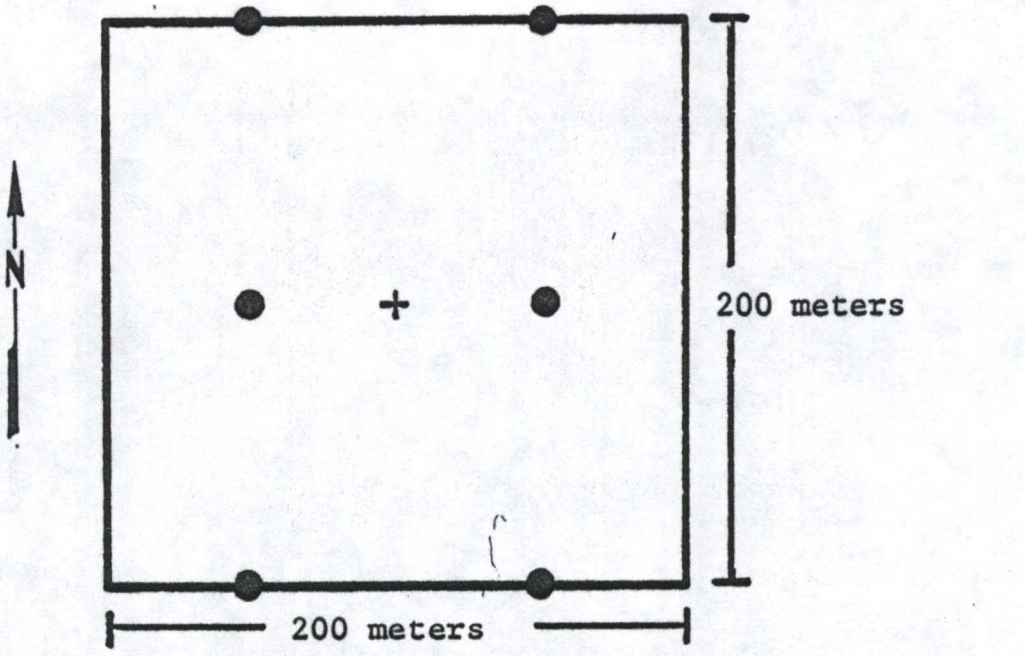


Figure 3. Typical Stationary Source Grid

that the monitors are upwind of existing sources, the measured values can be considered to be representative of background air quality, i.e., the air quality levels transported into the area from natural or distant anthropogenic sources.

The maximum measured and background pollutant levels determined from one year of monitoring data are listed in Table 2. Background values are the average of all of the one-hour average values when the monitor was upwind of the Prudhoe Bay sources. Background levels are very low, which appears reasonable due to the remoteness of the location. Table 2 shows that the 24-hour TSP standard was violated at Site 1. An exceedance of the 24-hour TSP NAAQS only occurred on one day in the one year monitoring period. Further investigation showed that this exceedance occurred at Site 1 on a day with winds of 45 mph with gusts to 60 mph, which suggests that the TSP composition was comprised largely of wind-blown native soil. This conclusion is further supported by the fact that a value of 112 micrograms per cubic meter (ug/m^3) was recorded at Site 2 during the same sampling period. Several times during the study the three-hour (6 to 9 a.m.) NAAQS for hydrocarbons was exceeded. The hydrocarbon standard is used only as a guideline in devising implementation plans for areas where the O_3 standard is violated. In each case, there was no evidence to show that the increased hydrocarbon levels contributed to increases in the ambient O_3 levels. However, these monitoring sites were not properly located to measure maximum O_3 levels resulting from Prudhoe Bay sources. Specifications for siting O_3 monitors are described in detail in "Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)," EPA-450/4-80-012, Nov., 1980. Table 2 shows that NAAQS were not exceeded during the sampling period for NO_2, O_3, CO, and SO_2.

The Prudhoe Bay area has a very harsh, Arctic climate with extremely cold winters and very cool summers. Dispersion conditions in the project area are generally good, primarily because of the good ventilation provided by frequent moderate to strong winds. Poor dispersion conditions do occur occasionally during stable conditions when winds are very light, but periods of poor dispersion are usually short-lived.

A one-year monitoring study was undertaken in the Prudhoe Bay area to obtain representative meteorological data which would be supportive of future air quality studies. Wind speed and wind direction data were collected at Site 1 and Site 2 (see Figure 1). An acoustic sounder was located at Site 1 to record inversion layers in the lower atmosphere. In addition, precipitation and visibility were measured at Site 2. Detailed meteorological information was collected at various levels on a 60 m communications tower (see Figure 1). The standard deviation of horizontal wind direction (sigma theta) was collected at the 60 m level of the communications tower.

Table 2
Maximum Measured and Background Pollutant Levels
4/1/79 to 3/31/80
(in micrograms per cubic meter)

Pollutant	Averaging Time	Maximum Site 2	Maximum Site 1	Background*	NAAQS
TSP	24 hour	112	294	11	260
	Annual geometric mean	7	11	11	75
NO_2	Annual arithmetic mean	4	4	2	100
O_3	1 hour	113	113	51	235
CO	1 hour	3,430	3,120	171	40,000
	8 hour	946	856	171	10,000
SO_2	3 hour	13	25	0	1,300
	24 hour	10	9	0	365
	Annual arithmetic mean	0.4	0.5	0	80
NMHC	6-9 a.m.	263	163	--	160

*The higher of the background values from the two sites was used for a background level in the air quality analysis.

To determine short-term and annual pollutant impacts in the air quality analysis, wind direction, wind speed, and temperature data were used from Site 1. The wind rose constructed from Site 1 data is shown in Figure 2. Comparison of the wind rose at Site 1 with wind roses for Barter Island (1958-1964 and 1968-1977) and Deadhorse Airport (1976) suggest that the Prudhoe Bay Site 1 data are representative of wind conditions in the area. Deadhorse Airfield (see Figure 1) is located immediately to the south of the existing Prudhoe Bay facilities, while Barter Island is located about 180 km to the east.

Hourly stability class estimates were made according to the modified sigma theta method recommended in the "Guideline on Air Quality Models, Proposed Revisions," EPA, OAQPS, Oct., 1980, with two exceptions:

The sigma theta measurements collected at the 60 meter level of the communications tower were used with a modification of the stability class limits to apply to 60 meters because sigma theta measurements were not made at the recommended height of 10 meters. To accomplish this, a formula given in a paper by Sedefian and Bennett titled "A Comparison of Turbulence Classification Schemes," Atmospheric Environment, Vol. 14, pp. 741-750, 1980 was used to adjust sigma theta stability class ranges. If no obstructions to wind flow are present, sigma theta measurements should be made at 10 meters because measurements taken above heights of 10 meters that are used in stability classifications may result in an underestimation of unstable classes.

The second exception to the guideline stability classification procedure involved changing E and F stability class estimates that occurred with wind speeds greater than 11 knots to D stability.

To account for surface roughness in the stability classification scheme, the sigma theta stability class ranges were adjusted by a formula listed in the "Guideline to Air Quality Models (Proposed Revisions)," Oct., 1980. A value of 0.27 centimeters was assumed as a reasonable approximation of the surface roughness in the Prudhoe Bay area.

Use of sigma theta in a stability classification scheme in nighttime conditions can result in an underestimation of stable classes because sigma theta, by itself, is a poor indicator of vertical dispersion. Large sigma theta values may be measured in light wind conditions when vertical dispersion would be minimal, and therefore by use of sigma theta, alone, unstable conditions would be overestimated. To account for this, a procedure developed by Mitchell and Timbre (1979) was used. This procedure is also described in the "Guideline to Air Quality Models (Proposed Revisions)," Oct., 1980.

Twice daily mixing heights were computed, through the use of the EPA Holzworth Program, from upper air data collected from Barter Island, and 10 meter temperature data collected from the Prudhoe Bay Monitoring Program. These twice daily mixing heights were input to the EPA PREP Program to calculate hourly mixing heights for the one-year period (4/1/79 to 3/31/80). The PREP Program was not designed to calculate mixing heights at locations above the Arctic Circle. Consequently, to account for this, a methodology was developed to modify the PREP Program. For a description of this methodology, refer to the Unit Owners' Waterflood PSD Application.

Hourly mixing heights calculated by the modified PREP Program, were used for the entire one-year period except for October 2, 1979 through February 2, 1980. During this time period, the maximum daily sun elevation angle above the horizon was less than about 10 degrees. Mixing height measurements made by the acoustic sounder, previously mentioned, were used in this time period because the PREP method of determining mixing heights is not applicable to the winter nighttime conditions that occur at Prudhoe Bay. The PREP method does not work in this winter period because it assumes that unstable conditions occur each day due to solar heating. Only mixing heights identified with a capping inversion by the acoustic sounder were used. When a capping inversion was not present, during the winter period, an arbitrary, large value of 5,000 meters was used.

For long-term modeling, an average annual afternoon mixing height of 300 meters was used. This value was obtained by averaging the Holzworth determined afternoon mixing heights.

B. Emission Characteristics

A complete listing of stack parameters and pollutant emission rates used in the modeling analysis for all existing sources, previously permitted sources, and proposed sources can be found in Appendix A of the ARCO/SOHIO PSD Application. The NO_x emission rates for the proposed PSD IV gas turbines in Appendix A were developed on the basis of an assumed emission concentration of 150 ppm. BACT for NO_x for the PSD IV gas turbines has been determined to be 100 ppm. Therefore, NO_x emission rates for the proposed PSD IV gas turbines will be less than the emission rates used in the modeling analysis, and the model results for these sources will be biased toward overestimation.

To simplify the analysis, the total emissions for all of the identical proposed ARCO/SOHIO sources at each location were modeled as a single point source. For example, at Gathering Center Two the total pollutant emission rate for three 7.5 MHP turbines was modeled as being emitted from the stack of one 5 MHP turbine. Table 3-3 of the ARCO/SOHIO PSD Application shows how the individual sources were grouped in the modeling analysis. This grouping of multiple sources into single point sources in the modeling analysis could lead to the slight overprediction of ground-level pollutant concentrations.

A certain amount of NO_x emitted is converted to nitrogen dioxide (NO_2). To determine this, a method developed by Cole and Summerhays, 1979, was used. This method, called the Ozone Limiting Method, is described in the next subsection.

All of the proposed PSD IV sources will have stack heights less than good engineering practice (GEP) as determined by the proposed EPA regulations (Federal Register, Vol. 44, No. 9, Jan. 12, 1979). High ground-level pollutant concentrations can result from pollutant emissions from stacks of heights less than GEP recommended heights due to building-wake-induced downwash of pollutants. For this reason, downwash was considered in the modeling analysis for all proposed sources, all existing sources, and all previously permitted sources which have stack heights lower than GEP recommended heights. The modeling approach used in the downwash analysis is described in the next subsection.

C. Model Methodology

The proposed PSD IV sources were modeled with existing sources, previously permitted sources, and proposed Alaska Gas Conditioning Facility (AGCF) sources to determine compliance with NAAQS. To determine compliance with PSD increments, all increment consuming sources were modeled together. Increment consuming sources are defined as all sources constructed (not previously permitted) after the baseline date for a particular pollutant. Baseline dates are pollutant-specific and are established for an area by the date after August 7, 1977 that the first completed PSD application for a major modification or major stationary source subject to EPA's PSD regulations as amended on August 7, 1980 is submitted. The complete application receipt determines the baseline date for each pollutant for which the construction described in the application significantly increases emissions. The baseline date for TSP was set on Nov. 13, 1978 by the Unit Owners PSD I Application, and the baseline date for SO_2 was set on April 2, 1981 by this PSD IV Application.

Short-term modeling was accomplished through the use of the rural version of the Industrial Source Complex Short-Term (ISCST) Model and the PTPLU Model. Long-term modeling was done through the use of the rural version of the Industrial Source Complex Long Term (ISCLT) Model. The short-term and long-term versions of the ISC Model are described in detail in the Industrial Source Complex (ISC) Dispersion Model User's Guide, Vol. 1, EPA-450/4-79-030, Dec., 1979. The PTPLU Model is described later in this subsection. The justification for use of the rural version of the ISC Model rather than the urban version of the model is based on a classification scheme described in "Guidelines on Air Quality Models," Proposed Revisions, EPA, Oct., 1980. The scheme allows an area to be classified urban or rural based on land use.

The ISC Model is not listed as a recommended model in EPA's "Guideline on Air Quality Models" (EPA-450/2-78-027 April, 1978) which is currently in force. However, the ISC Model has been proposed as a guideline model and is included in the "Guidelines on Air Quality Models," Proposed Revisions, EPA, Oct., 1980.

At this time, the ISC Model has not been thoroughly evaluated and it is still being tested. One validation study has shown that for plumes subject to building-wake effects, the building-wake effects option of the ISC Model significantly improves the performance of the ISC Model over that of the corresponding models (CRSTER and MPTER), which do not consider building-wake effects when used to calculate concentrations near the source. Data sets in this study were not sufficient in number and detail to validate new features of the model, however, it was possible to compare the performance of the ISC Model with the CRSTER and MPTER models. This study is described in detail in "An Evaluation Study for the Industrial Source Complex (ISC) Dispersion Model," EPA-450/4-81-002, Jan., 1981.

The ISC Model was used in this air quality analysis because building-wake-induced downwash of pollutants was viewed as a potential problem, and the ISC Model is the most suitable available model for use in calculating downwash of pollutants. The model was also judged to be appropriate for use in the Prudhoe Bay area because the terrain of the area is relatively flat. Since ISC is technically a non-Guideline Model, EPA hereby approves of its use for this application. EPA regulations require that notice and opportunity for public comment be given on this proposed approval.

For input into the ISC Model, each source at a specific facility listed in the emissions inventory in Appendix A of the PSD application was spaced randomly between 50 and 100 meters apart within a total grid box of 40,000 square meters. The center of each grid box has the approximate Universal Transverse Mercator (UTM) coordinates of the center of the specific facility (e.g., gathering center or flow station). An example of the random grid system used for the emission sources in the air quality analysis is shown in Figure 3. While this source representation deviates from reality, it is not expected to produce significant underpredictions of ambient impacts.

The annual stability wind rose constructed from the Prudhoe Bay Monitoring Study was used as meteorological input for long-term modeling with ISCLT. Pre-processed hourly meteorological data from the Prudhoe Bay Monitoring Study were input into the ISCST Model.

The modeling approach used in determining compliance with PSD increments and NAAQS for each pollutant subject to air quality review follows:

NO_2

A screening analysis was initially done with the ISCLT Model. This analysis showed that NO_2 concentrations from the proposed PSD IV sources exceeded significant ambient impact levels. Therefore, further modeling which included all NO_x sources in the Prudhoe Bay area was performed. In these further modeling runs, an 8 by 5 rectangular receptor grid with a .25 km spacing was placed around areas which had the highest NO_x emissions. From these runs, four areas of maximum impact were identified. More refined modeling was conducted in these areas to find the maximum NO_x impacts.

The Ozone Limiting Method was then applied to determine the maximum annual NO_2 concentration values from the maximum NO_x impacts determined from the refined modeling. The Ozone Limiting Method is described in detail in a paper by Cole and Summerhays, 1979, titled "A Review of Techniques Available for Estimating Short-Term NO_2 Concentrations." This method assumes that 10 percent of the oxides of nitrogen (NO_x) emitted is converted "in-stack" to NO_2. The remaining 90% of the NO_x emitted is oxidized to NO_2 by the available atmospheric O_3 present. The amount of NO_2 formation is restricted by the amount of O_3 present. The background O_3 concentration of 51 ug/m^3 was used in this analysis because it was assumed that existing Prudhoe Bay sources did not contribute to the ambient ozone concentration. The rationale for estimation of ambient O_3 concentration values in the Prudhoe Bay area is discussed at the end of this subsection.

The maximum annual predicted NO_2 concentration from the above modeling results was then added to the background NO_2 concentration to determine compliance with NAAQS. The results of this analysis are presented in the next subsection.

CO

The EPA PTPLU Model was used in the screening analysis to determine CO impacts on NAAQS from the proposed PSD IV sources. The model calculates maximum downwind pollutant concentrations along the plume centerline for an array of wind speeds and stability classes. The output consists of the maximum one-hour concentration for each wind speed and stability combination and the distance from the source at which it occurs.

In this analysis, CO emissions for each of the proposed 14 PSD IV sources were modeled for each stability class using the PTPLU Model. The maximum predicted CO concentrations from the PTPLU Model results were added for each stack. This modeling approach will likely result in the overprediction of ground-level CO concentrations for the following reasons: 1) All stacks were assumed to be located at one point, 2) Maximum concentrations were assumed to occur at the same point, 3) Maximum concentrations were summed without consideration given to differences in the wind speed and stability class associated with each individual maximum.

The maximum CO concentration predicted from this screening analysis was less than the one-hour and 8-hour level of significant ambient impact for CO so no further CO impact analysis was conducted. Results of the screening analysis are compared with EPA Levels of Significant Air Quality Impact in the next subsection.

SO_2

The ISCST Model was used initially in a screening analysis to determine areas of 3-hour and 24-hour significant impact. Receptors were placed at .25, .5, 1.0, and 2.0 km intervals along radials which were constructed 20 degrees apart in all directions from Flow Station 1 and Gathering Center 2. These locations were chosen because maximum SO_2 emissions from proposed PSD IV sources will occur at these two facilities. Results from this screening analysis showed that maximum predicted 3-hour and 24-hour SO_2 concentrations were below EPA Levels of Significant Ambient Impact. Therefore, no further analysis for short-term SO_2 impacts was warranted.

The ISCLT Model was used in a screening analysis to determine the potential for significant annual SO_2 impacts from the proposed PSD IV sources. An 8 by 5 rectangular receptor grid with a .25 km spacing was constructed around the eight facilities with maximum SO_2 emissions. These facilities included the PSD IV sources which had the highest SO_2 emissions. This analysis showed that no significant annual SO_2 impacts would occur from the proposed PSD IV sources. Therefore, no further annual SO_2 impact modeling was conducted.

TSP

A screening analysis was conducted to determine the potential for significant short-term and long-term TSP impacts from the proposed PSD IV sources. The modeling approach and receptor grid used above for determining significant 24-hour and annual SO_2 impacts was also used

for determining significant TSP impacts. This analysis showed that no significant annual TSP impacts would result from the proposed PSD IV sources. Therefore, no further annual impact modeling was necessary for TSP. However, the analysis showed that significant 24-hour impacts would occur. For this reason, more refined modeling was done for TSP for the 24-hour periods during which significant TSP impacts occurred.

More refined short-term modeling of the proposed PSD IV sources was conducted for TSP to determine compliance with NAAQS and PSD increments. From the above screening analysis, the 24-hour periods were identified during which TSP concentrations due to emissions from the proposed PSD IV sources were predicted to exceed the level of significant ambient impact. In this refined analysis, a 7 by 7 rectangular receptor grid with 0.1 km grid spacings were constructed around both Flow Station 1 and Gathering Center 2, which were the areas of maximum TSP concentrations identified in the screening analysis. All existing, previously permitted, and proposed sources of TSP were included in the ISCST Model for this analysis. To determine compliance with NAAQS the background TSP concentrations were added to the maximum predicted 24-hour TSP concentrations. To evaluate compliance with the 24-hour PSD increment, only increment-consuming TSP sources (i.e., those sources permitted after the baseline date) were modeled together. The results of this analysis are listed in the next subsection.

$\underline{O_3}$

According to a recent paper by Revlett titled "Ozone Forecasting Using Empirical Modeling", the formation of O_3 is dependent in part on hydrocarbon/nitrogen oxides ratios, solar radiation, humidity, and temperature. These factors combine to produce complex photochemical reactions, which can result in the production of O_3. Because of the complexities involved, photochemical modeling is costly and significant uncertainties exist, particularly for this arctic environment, beyond normal uncertainties expected in dispersion modeling of non-reactive pollutants. For these reasons, photochemical modeling was not attempted for the Prudhoe Bay sources.

Photochemical reactions involving emissions from the oil producing facilities are not expected to result in significant ozone formation in the Prudhoe Bay area for the following reasons: 1) Recent findings (Miller, 1978) suggest that hydrocarbon/NO_x ratios of 8/1 or more are critical to the formation of O_3 in photochemical reactions. It also has been shown that when the hydrocarbon/NO_x ratio is less than 8/1, peak ozone levels

are inversely proportional to the NO_x level. Emissions from the proposed PSD IV sources will result in hydrocarbon/NO_x ratios on the order of 1/30, which is much less than the critical photochemical ratio of 8/1. 2) The extreme meteorological conditions of Prudhoe Bay are not favorable for photochemical reactions because the intensity of solar radiation is low due to the fact that the sun angle (elevation of sun with respect to the horizon) never exceeds 45^{o}. Also, the low temperatures and humidity characteristic of the area are not favorable for photochemical reactions.

The Prudhoe Bay Monitoring Study, mentioned previously, showed that surface ozone concentrations at Prudhoe Bay remained fairly constant during the one-year study, and there was no evidence of significant diurnal fluctuation. A few rapid increases in surface O_3 concentrations were measured during the study, but these peaks were coincident with frontal passages and were likely stratospheric O_3 intrusions. These monitoring sites were not positioned far enough downwind of the Prudhoe Bay facilities to measure increases in O_3 concentrations resulting from emissions in the Prudhoe Bay area. Therefore, based on the monitoring study, it cannot be determined if the existing Prudhoe Bay facilities contributed to any increases in O_3 concentration.

From the above discussion, there are some uncertainties present in how the existing Prudhoe Bay sources are affecting the ambient O_3 concentration. However, because NO_x emissions will continue to far exceed hydrocarbon emissions with the operation of the proposed sources and because the arctic environment is not favorable for reactions leading to O_3 formation, it seems reasonable to conclude that ambient O_3 concentrations will not be increased significantly, with the addition of the PSD IV sources to the Prudhoe Bay area. For these reasons, the background O_3 concentration of 51 ug/m^3 is considered to properly represent the average ambient O_3 concentration in the Prudhoe Bay area with the addition of the PSD IV sources.

D. Model Results

The maximum predicted concentrations for each pollutant are compared to applicable NAAQS, PSD increments, and levels of significant ambient impact in Table 3.

NO_2

Annual NO_2 concentration maxima are predicted by the ISCLT Model to occur at points of .25 km from the lee side of several of the PSD IV sources which indicates that the maxima are primarily a result of assuming downwash is occurring. Table 3 shows that the maximum annual NO_2 impact (including background) to be 63 ug/m^3, which is less than the annual NAAQS of 100 ug/m^3. There exists some uncertainty whether these impacts would occur because the Prudhoe Bay buildings are built on elevated structures, which may restrict building-wake-induced downwash. If downwash did not occur, model predictions would be overestimates in the lee of buildings. It should be noted, however, that even if NO_2 impacts to the lee of buildings are ignored, the addition of previously permitted and proposed sources of NO_x will result in a general significant increase (20 ug/m^3 to 30 ug/m^3) in NO_2 levels in the Prudhoe Bay area. This is illustrated by comparing Figure 4 with Figure 9.2-3 of the Unit Owners PSD I Application.

The ISC modeling results are based on an emission rate for NO_x of 150 ppm for the proposed PSD IV gas turbines. BACT for the PSD IV gas turbines will limit NO_x emissions to 100 ppm. Therefore, this air quality analysis has likely resulted in an overestimation of ground-level NO_2 impacts from the proposed PSD IV sources.

CO

The maximum CO impacts were determined for "worst case" meteorological conditions for all of the PSD IV sources. Table 3 shows that maximum one-hour ground-level CO concentrations are less than both the one-hour and 8-hour level of significant ambient impact for CO.

SO_2

As shown in Table 3, the modeling analysis predicted that no significant short-term or long-term SO_2 impacts would occur from the operation of the proposed PSD IV sources.

TSP

The ISCST Model showed that the maximum 24-hour TSP concentration would occur .25 km to the west-southwest of Flow Station 1. Another TSP concentration maximum was predicted to occur .25 km to the west-southwest of Gathering Center 2. These concentration maxima were predicted to occur on Julian day 257, which was characterized by persistent strong winds from the

Table 3
Comparison of Estimated Maximum Impacts
from the Proposed PSD IV Sources with Applicable
National Ambient Air Quality Standards (NAAQS),
PSD Increments, and Levels of Significant Ambient Impact

All concentrations are in micrograms per cubic meter

Pollutant	Averaging Time	PSD IV Sources	Level of Significant Ambient Increment	All Increment Consuming Sources	Class II PSD Increment	All Sources	Background	Total	NAAQS
SO_2	3 hours	3.3	25	*	512	*	0	--	1,300
	24 hours	2.0	5	*	91	*	0	--	365
	Annual	0.7	1	*	20	*	0	--	80
TSP	24 hours	--	5	21	37	25	11	36	150
	Annual	.86	1	*	19	*	11	--	60
CO	1 hour	113	2,000	**	**	*	171	--	40,000
	8 hours	79	500	**	**	*	171	--	10,000
NO_2	Annual	--	1	**	**	61	2	63	100

* No further modeling necessary because no significant impacts expected.
** No PSD increments exist for CO and NO_2.

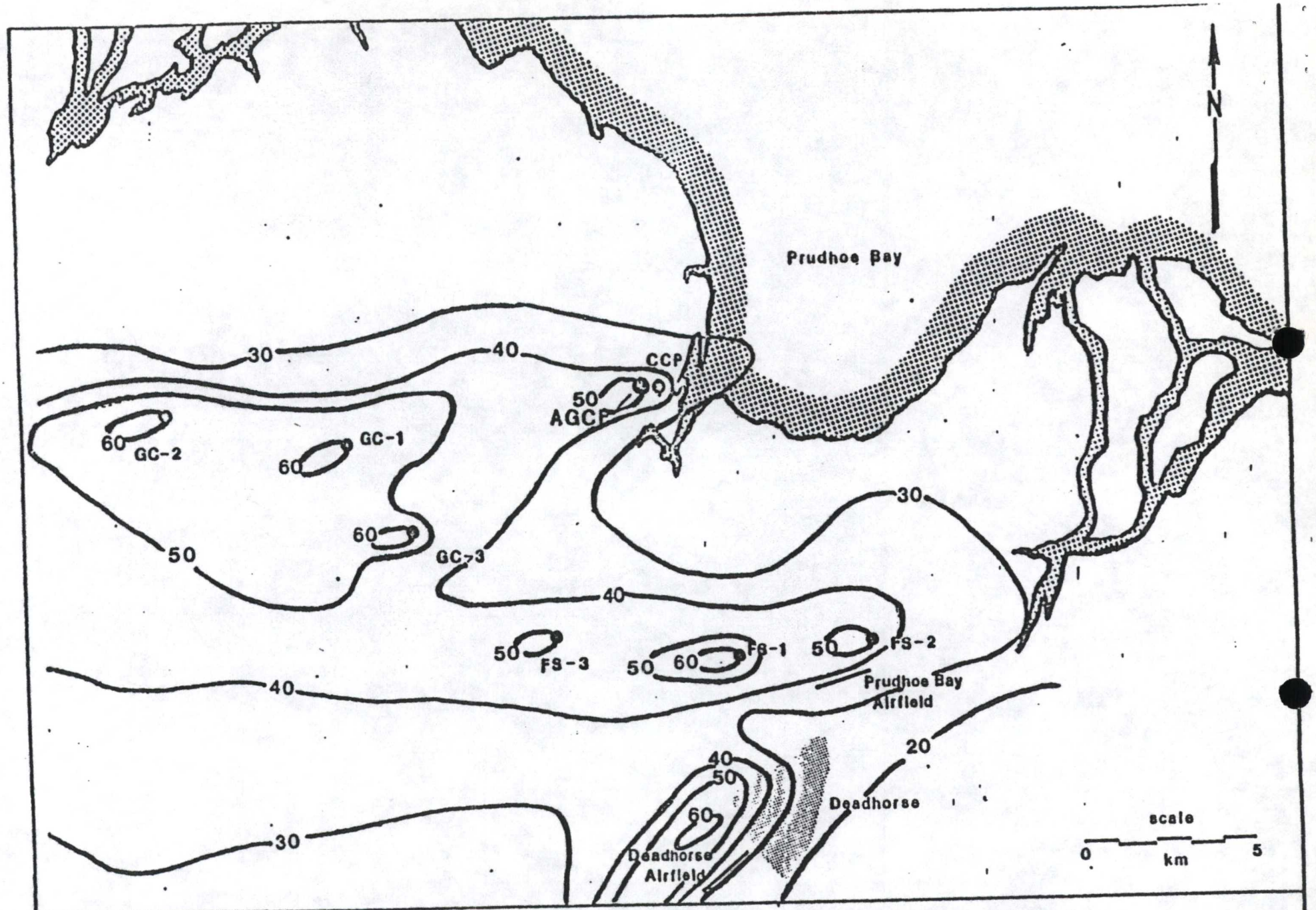


Figure 4 Calculated Annual Average NO_2 Concentrations ($\mu g/m^3$) for All Sources Including Background.

When NO_2 is emitted in sufficient quantities, a reddish-brown plume may result. NO_2 plumes may be visible for a short distance downwind of the Prudhoe Bay facilities, at times. This may result in some local degradation of visibility.

Enhancement of ice fog in the Prudhoe Bay area may result from the proposed plant plumes, exhausts from the associated additional vehicles and buildings, and the respiration of the increased number of people in the area. This enchancement of ice fog may result in an increase in duration and frequency of occurrence in the already-existing reduction of visibility in the Prudhoe Bay area.

Growth Impacts

It is expected that little, if any, increase in the work force in the Prudhoe Bay area will result from the operation of the PSD IV sources. Therefore, no additional air quality impacts, other than those mentioned in the model results subsection, are expected.

IV. Findings and Recommendations

Based on the air quality analysis, the operation of the proposed PSD IV sources is not expected to result in the violation of any PSD increments or NAAQS.

Emission Limitations

Maximum allowable emissions from the proposed modification are summarized below:

Equipment	Pollutant	Limit (t/yr)
Gas Turbines	NO_x	5,397
"	VOC	26.5
"	CO	1,460
"	PM	198
"	SO_2	48
Process Heaters	NO_x	88
"	VOC	.5
"	CO	21
"	PM	12
"	SO_2	4

These are overall limits for the facilities listed in Table 1.

In addition, specific performance limits for the turbines and heaters are as follows:

Equipment	Pollutant	Emission Limit
Gas Turbines	NO_x	100 (14.4/Y) ppm*
	CO	109 lb/10^6 scf of fuel used
		10% Opacity
Process Heaters	NO_x	0.08 lb/10^6 BTU
	CO	0.018 lb/10^6 BTU

*NO_x emissions factor for gas-fired turbines is modified by an efficiency factor (Y = manufacturer's rated heat rate at rated peak load) which cannot exceed 14.4 kilojoules/watt-hour. Based at 15% oxygen on a dry basis.

Compliance Determination

Compliance with the emission limitations shall be demonstrated by the company conducting source tests and a program of emissions monitoring as described below.

(1) Compliance testing shall be conducted within 60 days after achieving the maximum production rate at which the turbines or process heaters will be operated but not later than 180 days after startup of the specific emission source. The NSPS testing requirements for NO_x from gas turbines (40 CFR 60.335) shall be followed. The company may submit for EPA approval an alternative test plan for the gas turbines addressing such alternatives as factory testing rather than on-site testing and testing of a certain proportion of the gas turbines from each model group rather than each individual gas turbine. EPA Method 7 shall be used for NO_x from the process heaters. Only one of each kind of process heater must be tested. The company shall submit a test plan to EPA for approval to demonstrate that the process heater tested is representative of the process heaters for which testing is exempted. No compliance testing is required for CO.

(2) Compliance Monitoring--In addition to the NSPS requirements (40 CFR 60.334) one of the following monitoring schemes is required: (a) a continuous monitoring system shall be installed to monitor CO or O_2 for all gas-fired process heaters. These monitors shall comply with the specification requirements in Appendix B of 40 CFR Part 60; or (b) a periodic monitoring program for the process heaters using a portable CO or O_2 analyzer. The company shall submit a monitoring plan to EPA for approval prior to startup describing the details of the program such as monitoring frequency, proposed instrumentation, and quality assurance procedures.

File: Arco/Sohio PSD II
Ray

STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

JAY S. HAMMOND, GOVERNOR

465-2666

POUCH O – JUNEAU 99811

April 20, 1981

Mr. Michael Johnston
New Sources Permits Section
U.S. Environmental Protection Agency
Region X M/S 521
1200 Sixth Avenue
Seattle, WA 98101

Dear Mike,

Thursday, April 16, 1981, a meeting was conducted in our office with representatives of ARCO and SOHIO regarding a state permit to operate new sources of air pollution modifying the present facilities at Prudhoe Bay, Alaska.

Persons attending the meeting included Pat Metz and Kevin Meyers of ARCO, Del Diaz and Mark Wagner of SOHIO, and Stan Hungerford and myself.

Generally, topics of the meeting included specific details of the air quality modeling techniques and the BACT evaluation of the proposed equipment. The advantages and disadvantages of the Industrial Source Complex model with and without the aerodynamic downwash option were discussed in addition to modeling inputs, ambient ozone projections based upon hydrocarbon emissions and BACT for turbines with dry controls were examined with respect to NOx emissions of less than 150 ppm.

Sincerely,

Tom Chapple

Tom Chapple
Air Quality Engineer

UNITED STATES GOVERNMENT

2-Way Memo

Subject: PSD Permit Application
ARCO/SOHIO (PSD IV)

DATE OF MESSAGE
April 9, 1981
DATE OF REPLY

INSTRUCTIONS
Use routing symbols whenever possible.
SENDER:
Forward original and one copy.
Conserve space.
RECEIVER:
Reply below the message, keep one copy, return one copy.

To: Michael M. Johnston, Chief
New Source Permits Section (M/S 521)

FOLD — FOLD

USE BRIEF, INFORMAL LANGUAGE

April 2, 1981 - COMPLETE

The requested information concerning the air quality portion of the PSD application has been received. With respect to the air quality analysis, the application can now be considered complete.

The BACT section of the PSD application was previously determined to be complete.

CC. Paul Boys

From: Robert G. Courson, Chief
Technical Support Branch (M/S 329)

5027-102

1. TO BE RETAINED BY ADDRESSEE

OPTIONAL FORM 27
OCTOBER 1962
GSA FPMR (41 CFR) 101-11.6

Ray
file

March 27, 1981

Mr. Michael M. Johnston, Chief
New Source Permits Section, Region X
U. S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, Washington 98101

Subject: Response to Request for Additional Information on the Prudhoe Bay Unit PSD IV Application.

Dear Mr. Johnston:

On March 13, 1981, a request for additional information was received from USEPA, Region X concerning the Prudhoe Bay Unit PSD IV permit application. In response to this request, Sohio Alaska Petroleum Company and ARCO Alaska, Inc. hereby submit the attached comments on behalf of the Prudhoe Bay Unit Owners. It is intended that this information be adequate for the EPA to determine that the PSD IV permit application is complete.

The attached responses to EPA comments result only in a clarification of the content of the PSD IV application and do not result in a significant change in air quality impacts. Therefore, we continue to anticipate an early resolution of the PSD permit review. To maintain current project schedules and meet financial commitments will still require an approval of our request by September 1, 1981. We would be pleased to discuss our comments in further detail if you so desire.

Very truly yours,

Mark R. Wagner

M. R. Wagner
Sohio Alaska Petroleum Company

W. P. Metz
ARCO Alaska, Inc.

MRW/km

Attachments
cc: Mr. Tom Hanna, ADEC - Juneau
Mr. Doug Lowery, ADEC - Fairbanks
Mr. Jim Sweeney, EPA - Anchorage

EPA COMMENT 1:

Section 6.2.2 - What were the hourly meteorological conditions associated with the maximum short-term SO_2 impacts?

RESPONSE:

Tables of hourly meteorological conditions associated with maximum 24-hour and 3-hour SO_2 concentrations (assuming uncorrected sigma theta ranges) are attached. Also included in this table are stability classes determined from the corrected sigma theta ranges (see EPA Comment 4). The meteorological conditions associated with the maximum 24-hour and 3-hour SO_2 concentrations did not change due to the correction of sigma theta ranges. All stability classes remained D.

RADIAN
CORPORATION

HOURLY METEOROLOGICAL
CONDITIONS ASSOCIATED WITH 24-HOUR MAXIMUM SO_2 IMPACTS
(JULIAN DAY 85)

Hour	Wind Speed (m/s)	Wind Direction (Deg)	Temp (^{o}K)	Mixing Height (m)	Stability Class Uncorrected $\sigma\epsilon$	Corrected $\sigma\theta$
1	7.5	239	248	191	D	D
2	9.0	242	249	191	D	D
3	7.8	240	248	191	D	D
4	6.8	234	248	191	D	D
5	9.1	239	248	191	D	D
6	10.4	242	249	8	D	D
7	10.8	244	249	31	D	D
8	11.3	243	249	54	D	D
9	10.1	238	250	77	D	D
10	10.2	238	250	99	D	D
11	10.3	237	250	122	D	D
12	10.5	236	250	145	D	D
13	10.9	235	250	168	D	D
14	11.4	239	250	191	D	D
15	10.4	238	250	191	D	D
16	9.8	237	250	191	D	D
17	9.0	234	250	191	D	D
18	8.9	235	249	191	D	D
19	8.5	235	248	191	D	D
20	9.0	237	248	191	D	D
21	8.9	239	248	191	D	D
22	7.6	235	247	191	D	D
23	6.7	232	246	191	D	D
24	5.6	232	246	191	D	D

RADIAN
CORPORATION

HOURLY METEOROLOGICAL CONDITIONS
ASSOCIATED WITH 3-HOUR MAXIMUM SO_2 IMPACTS
(JULIAN DAY 232)

Hour	Wind Speed (m/s)	Wind Direction (Deg)	Temp (^oK)	Mixing Height (m)	Stability Class Uncorrected $\sigma\Theta$	Stability Class Corrected $\sigma\Theta$
22	5.2	278	280	22	D	D
23	5.2	277	280	36	D	D
24	5.2	277	280	49	D	D

EPA COMMENT 2:

Section 6.3.1 - What was the maximum NO_2 impact of the proposed sources alone? We would appreciate a map of the Prudhoe Bay area showing the spatial distribution of predicted annual NO_2 concentrations due to all sources.

RESPONSE:

Previous annual NO_x modeling results, based on surface roughness adjusted sigma thetas, rather than on adjusted sigma theta ranges, were used to determine the maximum impact of proposed sources only. The predicted NO_2 level due to the proposed sources is 1.2 $\mu g/m^3$.

Also, as part of the response to this comment, a map showing the spatial distribution of predicted annual NO_2 concentrations due to all sources is attached.

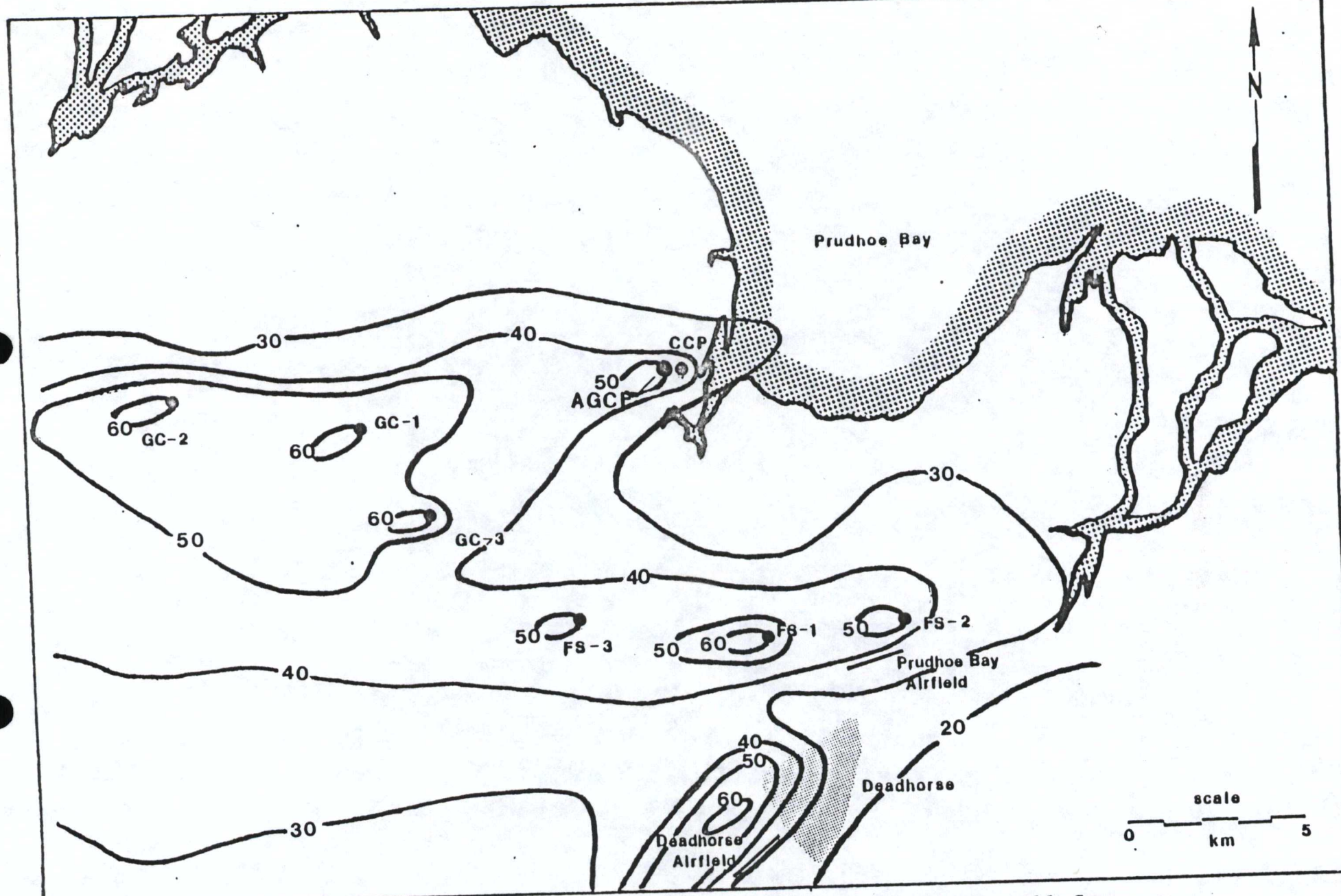


Figure 4-1. Calculated Annual Average NO_2 Concentrations ($\mu g/m^3$) for All Sources Including Background.

EPA COMMENT 3:

Section 6.3.2 - What were the hourly meteorological conditions associated with the maximum short-term TSP impacts?

RESPONSE:

A table of hourly meteorological conditions associated with maximum 24-hour TSP concentrations (assuming uncorrected sigma theta ranges) is attached. Also included in this table are stability classes determined from the corrected sigma theta ranges (see EPA Comment 4). As a result of the correction to the meteorological data for Day 257, two hours of D stability changed to C stability and one hour of D changed to B.

RADIAN
CORPORATION

HOURLY METEOROLOGICAL CONDITIONS ASSOCIATED WITH 24-HOUR MAXIMUM TSP IMPACTS

(JULIAN DAY 257)

Hour	Wind Speed (m/s)	Wind Direction (Deg)	Temp (^{o}K)	Mixing Height (m)	Stability Class* Uncorrected $\sigma\theta$	Corrected $\sigma\theta$
1	12.7	251	271	673	D	D
2	12.8	254	271	690	D	D
3	12.9	252	271	708	D	D
4	13.9	252	271	725	D	D
5	14.0	257	271	742	D	D
6	13.6	260	272	90	D	D
7	12.9	259	271	191	D	D
8	13.3	256	271	292	D	D
9	13.9	250	272	393	D	C
10	14.7	251	272	494	D	D
11	14.5	253	272	596	D	D
12	14.8	253	273	697	D	D
13	14.8	254	273	798	D	D
14	15.3	257	273	899	D	D
15	15.1	257	273	899	D	D
16	15.1	260	272	899	D	D
17	15.2	260	272	899	D	C
18	14.8	257	272	899	D	B
19	14.8	253	272	888	D	D
20	14.9	253	272	865	D	D
21	13.8	257	272	842	D	D
22	12.5	262	272	820	D	D
23	13.3	255	272	797	D	D
24	12.6	256	273	774	D	D

*Meteorological conditions other than stability were unaffected by the sigma theta correction.

EPA COMMENT 4:

Appendix C, p. C-5 - The modification for surface roughness of sigma theta (standard deviation of horizontal wind direction fluctuations) was applied incorrectly. The adjustment factor $(Z_o/15cm)^{0.2}$ should have been applied to the values in the stability classification table, rather than to the measured values. This error resulted from an inaccuracy in proposed EPA guidance (Proposed Revisions to Guideline on Air Quality Models, October 1980). We request that either 1) the error be corrected, the meteorological data be re-analyzed, and the modeling estimates be re-calculated, or 2) a demonstration be made that the error causes the concentration estimates to be conservatively high or changed by an insignificant amount.

RESPONSE:

The processing error in the meteorological data has been corrected. The correction resulted in a modified STAR deck used for annual modeling and a modified PREP file for short-term modeling. The corrected STAR data are presented in revised tables for Appendix E and a revised Table 4-1 (attached). The correction gave approximately the same frequency of D (neutral) stability, an increase in unstable (A, B, and C) conditions, and a decrease in stable (E + F) conditions. The overall effect on modeled pollutant concentrations was a decrease in annual average concentrations and no significant change in short-term concentrations. The results of the corrected modeling analyses are presented in the attached revisions to Tables 6-2 and 6-3.

The highest modeled NO_x concentration of 115 $\mu g/m^3$ was obtained using meteorological input based on the corrected sigma theta values. Previous modeling with incorrect sigma theta values yielded a maximum NO_x value of 133 $\mu g/m^3$. Similar decreases are expected elsewhere in the Prudhoe Bay Field; there-

fore, it is concluded that the original modeling results represent a "worse-case" air quality impact for NO_x, and thus for NO_2.

Maximum 24-hour TSP concentrations were predicted with the revised meteorological data. For the worst-case 24-hour period (Julian Day 257), the maximum TSP concentration from all sources, including background, remained virtually unchanged from the previous prediction (see revised Table 6-3). As a result of the correction to the meteorological data for Day 257, two hours of D stability changed to C stability and one hour of D changed to B. For the only other 24-hour period for which TSP concentrations were predicted to exceed significant levels (Julian Day 157), two hours of D stability changed to C stability and three hours of D stability changed to B. All other hourly stabilities remained as D.

Additional modeling was performed for worst-case 3-hour and 24-hour dispersion periods identified in the previous modeling analyses for SO_2. In addition, annual SO_2 and particulate concentrations were predicted with the revised STAR deck. Predicted concentrations do not exceed established significance levels with the revised meteorological conditions input to the models.

(Revised 3/16/81)

ANN RELATIVE FREQUENCY DISTRIBUTION STATION =PRUDHOE BAY(1979-1980)

DIRECTION	SPEED(KTS) 0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	.002231	.005988	.002583	.000352	.000000	.000000	.011154
NNE	.001174	.005754	.001996	.000000	.000000	.000000	.008923
NE	.001292	.007514	.003053	.000235	.000000	.000000	.012093
ENE	.000704	.003640	.002583	.000352	.000117	.000000	.007397
E	.000587	.003405	.002348	.000587	.000352	.000000	.007280
ESE	.001174	.001292	.001409	.000352	.000000	.000000	.004227
SE	.000470	.002231	.001879	.000000	.000000	.000000	.004579
SSE	.000235	.001644	.000822	.000000	.000000	.000000	.002700
S	.000939	.001526	.000587	.000352	.000000	.000000	.003405
SSW	.000822	.000939	.001174	.000235	.000000	.000000	.003170
SW	.000587	.003053	.001409	.000470	.000000	.000000	.005518
WSW	.000235	.001996	.001409	.000704	.000117	.000000	.004462
W	.000704	.001761	.001057	.001174	.000117	.000000	.004814
WNW	.000704	.002583	.001174	.000352	.000000	.000000	.004814
NW	.000939	.002583	.001761	.000470	.000000	.000000	.005753
NNW	.001526	.003757	.002466	.000352	.000000	.000000	.008101
TOTAL	.014324	.049665	.027709	.005988	.000704	.000000	

RELATIVE FREQUENCY OF OCCURRENCE OF A STABILITY = .098391
RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH A STABILITY = .000000

RADIAN CORPORATION

(Revised 3/16/81)

ANN RELATIVE FREQUENCY DISTRIBUTION STATION =PRUDHOE BAY(1979-1980)

DIRECTION	SPEED(KTS) 0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	.000000	.000939	.001409	.000235	.000000	.000000	.002583
NNE	.000000	.000939	.002231	.000117	.000000	.000000	.003288
NE	.000235	.003288	.006458	.000704	.000000	.000000	.010685
ENE	.000235	.002700	.004814	.002818	.000117	.000117	.010802
E	.000235	.001879	.002583	.001526	.000117	.000470	.006810
ESE	.000117	.001292	.002935	.001292	.000000	.000117	.005753
SE	.000000	.000822	.000352	.000235	.000000	.000000	.001409
SSE	.000235	.000117	.000235	.000000	.000000	.000000	.000587
S	.000117	.000352	.000117	.000000	.000000	.000000	.000587
SSW	.000000	.000352	.001292	.000470	.000000	.000000	.002113
SW	.000117	.000704	.000939	.000235	.000117	.000000	.002113
WSW	.000235	.001057	.001174	.001057	.000235	.000117	.003875
W	.000117	.000822	.001879	.001409	.000117	.000000	.004344
WNW	.000000	.000704	.001879	.001761	.000000	.000000	.004344
NW	.000117	.000235	.000939	.000470	.000000	.000000	.001761
NNW	.000000	.000352	.000822	.000587	.000000	.000000	.001761
TOTAL	.001761	.016555	.030058	.012915	.000704	.000822	

RELATIVE FREQUENCY OF OCCURRENCE OF B STABILITY = .062815
RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH B STABILITY = .000000

RADIAN CORPORATION

(Revised 3/16/81)

RADIAN CORPORATION

ANN RELATIVE FREQUENCY DISTRIBUTION STATION =PRUDHOE BAY(1979-1980)

DIRECTION	SPEED(KTS) 0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	.000000	.000470	.000704	.000470	.000000	.000000	.001644
NNE	.000235	.000235	.001174	.000704	.000000	.000000	.002348
NE	.000117	.001879	.006340	.001996	.000117	.000000	.010450
ENE	.000235	.001057	.007045	.000454	.001996	.001879	.020665
E	.000117	.002231	.006223	.007162	.002700	.002113	.020547
ESE	.000117	.000822	.002466	.002231	.000235	.000000	.005871
SE	.000000	.000352	.002113	.000000	.000000	.000000	.002466
SSE	.000000	.000235	.000117	.000000	.000000	.000000	.000352
S	.000117	.000235	.000117	.000117	.000000	.000000	.000587
SSW	.000235	.000000	.000822	.000235	.000000	.000000	.001292
SW	.000000	.001292	.000822	.001526	.000000	.000000	.003640
WSW	.000000	.001057	.001526	.001996	.000235	.000235	.005049
W	.000000	.000587	.001996	.002700	.000704	.000352	.006340
WNW	.000000	.000117	.001409	.002466	.000822	.000117	.004931
NW	.000000	.000117	.000352	.000352	.000000	.000000	.000822
NNW	.000000	.000352	.000000	.000235	.000000	.000000	.000587
TOTAL	.001174	.011037	.033228	.030645	.006810	.004696	

RELATIVE FREQUENCY OF OCCURRENCE OF C STABILITY = .087590
RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH C STABILITY = .000000

(Revised 3/16/81)

ANN RELATIVE FREQUENCY DISTRIBUTION STATION =PRUDHOE BAY(1979-1980)

DIRECTION	SPEED(KTS) 0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	.000715	.001644	.003757	.000704	.000000	.000000	.006820
NNE	.001068	.001526	.003288	.003288	.000117	.000000	.009287
NE	.001445	.006692	.015616	.019608	.003522	.001057	.047940
ENE	.000961	.003875	.018786	.052366	.037807	.023600	.137393
E	.001793	.005518	.018669	.046965	.033110	.042151	.148206
ESE	.000435	.003053	.009745	.009510	.004814	.000822	.028429
SE	.000476	.001057	.002918	.001292	.000000	.000000	.005643
SSE	.000355	.000352	.001761	.001644	.000000	.000000	.004113
S	.000121	.000587	.003170	.000704	.000000	.000000	.004582
SSW	.000126	.001761	.010685	.006810	.000000	.000000	.019381
SW	.000491	.004462	.010551	.022191	.005753	.002466	.053914
WSW	.000252	.003757	.017142	.033697	.012446	.011859	.079153
W	.000374	.004696	.018199	.014324	.005636	.007280	.050509
WNW	.000249	.002935	.006575	.004579	.001057	.000587	.015982
NW	.000121	.000704	.003522	.001174	.000000	.000000	.005522
NNW	.000361	.001526	.003405	.000117	.000000	.000000	.005409
TOTAL	.009333	.044147	.155688	.218974	.104262	.089020	

RELATIVE FREQUENCY OF OCCURRENCE OF D STABILITY = .622285
RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH D STABILITY = .000235

RADIAN CORPORATION

(Revised 3/16/81)

ANN RELATIVE FREQUENCY DISTRIBUTION STATION =PRUDHOE BAY(1979-1980)

DIR DIR DIRI IAAA	DIRECTION	SPEED(KTS) 0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL'
	N	.000359	.000470	.000704	.000000	.000000	.000000	.001533
	NNE	.000601	.001174	.000939	.000000	.000000	.000000	.002715
	NE	.001030	.001761	.006692	.000000	.000000	.000000	.009533
	ENE	.000976	.003522	.006692	.000000	.000000	.000000	.011190
	E	.000374	.002348	.005284	.000000	.000000	.000000	.008006
	ESE	.000604	.001526	.001174	.000000	.000000	.000000	.003305
	SE	.000121	.000352	.000000	.000000	.000000	.000000	.000473
	SSE	.000006	.000704	.000000	.000000	.000000	.000000	.000710
	S	.000240	.000352	.000235	.000000	.000000	.000000	.000827
	SSW	.000364	.001057	.001644	.000000	.000000	.000000	.003064
	SW	.000610	.002231	.006575	.000000	.000000	.000000	.009416
	WSW	.000134	.001879	.006927	.000000	.000000	.000000	.008940
	W	.000372	.002113	.003757	.000000	.000000	.000000	.006243
	WNW	.000715	.000587	.000470	.000000	.000000	.000000	.001772
	NW	.000360	.000587	.000470	.000000	.000000	.000000	.001417
	NNW	.000834	.000704	.000117	.000000	.000000	.000000	.001656
	TOTAL	.007749	.021369	.041681	.000000	.000000	.000000	

RELATIVE FREQUENCY OF OCCURRENCE OF E STABILITY = .070800
RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH E STABILITY = .000235

RADIAN CORPORATION

(Revised 3/16/81)

ANN RELATIVE FREQUENCY DISTRIBUTION STATION =PRUDHOE BAY(1979-1980)

DIRECTION	SPEED(KTS) 0 - 3	4 - 6	7 - 10	11 - 16	17 - 21	GREATER THAN 21	TOTAL
N	.000587	.001292	.000000	.000000	.000000	.000000	.001879
NNE	.000587	.000939	.000000	.000000	.000000	.000000	.001526
NE	.000587	.001292	.000117	.000000	.000000	.000000	.001996
ENE	.000704	.001292	.000000	.000000	.000000	.000000	.001996
E	.000822	.003405	.000117	.000000	.000000	.000000	.004344
ESE	.001761	.003757	.000000	.000000	.000000	.000000	.005518
SE	.001761	.002348	.000000	.000000	.000000	.000000	.004109
SSE	.001409	.001292	.000000	.000000	.000000	.000000	.002700
S	.001526	.002348	.000000	.000000	.000000	.000000	.003875
SSW	.001526	.002231	.000000	.000000	.000000	.000000	.003757
SW	.001879	.005284	.000117	.000000	.000000	.000000	.007280
WSW	.002231	.002700	.000000	.000000	.000000	.000000	.004931
W	.002231	.002231	.000000	.000000	.000000	.000000	.004462
WNW	.001526	.002113	.000000	.000000	.000000	.000000	.003640
NW	.001057	.002348	.000000	.000000	.000000	.000000	.003405
NNW	.000822	.001879	.000000	.000000	.000000	.000000	.002700
TOTAL	.021017	.036750	.000352	.000000	.000000	.000000	

RELATIVE FREQUENCY OF OCCURRENCE OF F STABILITY = .050119
RELATIVE FREQUENCY OF CALMS DISTRIBUTED ABOVE WITH F STABILITY = .000000

RADIAN CORPORATION

TABLE 4-1. ANNUAL FREQUENCY DISTRIBUTIONS OF PASQUILL STABILITY CLASSES WITH AVERAGE WIND SPEED BY STABILITY CLASS

Stability Class	Definition	Corrected Stabilities* for Prudhoe Bay (1979-1980)		Previously Calculated Stabilities for Prudhoe Bay (1979-1980)	
		Annual Frequency (percent)	Average Wind Speed (mph)	Annual Frequency (percent)	Average Wind Speed (mph)
A	Extremely Unstable	9.84	6.1	0.76	5.5
B	Unstable	6.28	8.4	0.63	5.3
C	Slightly Unstable	8.76	11.3	1.18	5.1
D	Neutral	62.23	14.1	61.16	14.8
E	Slightly Stable	7.08	6.7	19.80	6.4
F	Extremely Stable	5.81	3.8	16.37	6.9

Source: Radian Corporation, Air Quality and Meteorological Monitoring Study at Prudhoe Bay, Alaska (April 1, 1979 to March 31, 1980) October 1980.

*Based on proper application of the surface roughness correction factor.

**Based on application of the surface correction factor as described in the proposed revisions to EPA's Guideline on Air Quality Models, October 1980.

TABLE 6-2
MAXIMUM PREDICTED ANNUAL
NO_2 CONCENTRATIONS ($\mu g/m^3$)

Pollutant Sources	Corrected Sigma Thetas Maximum Impact All Sources	Uncorrected Sigma Thetas Maximum Impact All Sources	Primary and Secondary NAAQS
Background	2.0	2.0	
Prudhoe Bay Area	60.5	62.3	
TOTAL	62.5	64.3	100

TABLE 6-3

REVISED MAXIMUM PREDICTED 24-HOUR

TSP CONCENTRATIONS ($\mu g/m^3$)

	Uncorrected Data All Sources	Corrected Data All Sources
Background	11.0	11.0
Existing Sources	4.28	4.25
Permitted and Proposed Sources	20.29	21.02
Impact on PSD Class II Increment	20.29	21.02
Impact on NAAQS	35.57	36.27
Allowable 24-Hour Class II Increment	37	37
Primary 24-Hour NAAQS	260	260
Secondary 24-Hour NAAQS	150	150

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PSD IV

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M/S 521

MAR 0 9 1981

Mr. P. B. Norgaard
ARCO Oil and Gas Company
P.O. Box 360
Anchorage, AK 99510

Dear Mr. Norgaard:

On February 9, 1981, EPA Region X received a Prevention of Significant Deterioration permit application for the installation of gas-fired turbines and heaters at the Prudhoe Bay, Alaska site (PSD IV).

Our technical staff has reviewed the application for completeness and has determined that a number of points need further clarification before the application can be considered complete. Many of these points may have already been discussed with your consultant during recent telephone conversations in an effort to move the permitting process along without delay.

The attachment contains the specific comments, questions and requests for additional information.

In light of your request to have an early resolution of the permit review I suggest that you make every effort to turn around the information request in as short a time frame as possible. Continued close cooperation between our staffs will further expedite the process.

Any questions related to BACT should be directed to Paul Boys at (206) 442-1106 and questions regarding the air quality impact analysis should be addressed to Rob Wilson at (206) 442-0887. If any questions should arise concerning the administrative aspects of the PSD program, please feel free to contact Ray Nye of my staff at (206) 442-7176.

Sincerely,

Michael M. Johnston, Chief
New Source Permits Section

Enclosure

LMARSHALL:jb:3-09-81(#0641N)

PS Form 3811, Aug. 1978

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- ☐ RESTRICTED DELIVERY.
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2. ARTICLE ADDRESSED TO:

G.N. Nelson
PSD IV

3. ARTICLE DESCRIPTION:

REGISTERED NO.	CERTIFIED NO.	INSURED NO.
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PERMITS BRANCH M/S #521
1200 SIXTH AVENUE
SEATTLE, WA 98101

(Name of Sender)

(Street or P. O. Box)

(City, State, and ZIP Code)

M/S 521

MAR 0 9 1981

Mr. G. N. Nelson
SOHIO Petroleum Company
Pouch 6-612
Anchorage, Alaska 99502

Dear Mr. Nelson:

On February 9, 1981, EPA Region X received a Prevention of Significant Deterioration permit application for the installation of gas-fired turbines and heaters at the Prudhoe Bay, Alaska site (PSD IV).

Our technical staff has reviewed the application for completeness and has determined that a number of points need further clarification before the application can be considered complete. Many of these points may have already been discussed with your consultant during recent telephone conversations in an effort to move the permitting process along without delay.

The attachment contains the specific comments, questions and requests for additional information.

In light of your request to have an early resolution of the permit review I suggest that you make every effort to turn around the information request in as short a time frame as possible. Continued close cooperation between our staffs will further expedite the process.

Any questions related to BACT should be directed to Paul Boys at (206) 442-1106 and questions regarding the air quality impact analysis should be addressed to Rob Wilson at (206) 442-0887. If any questions should arise concerning the administrative aspects of the PSD program, please feel free to contact Ray Nye of my staff at (206) 442-7176.

Sincerely,

Michael M. Johnston, Chief
New Source Permits Section

Enclosure

LMARSHALL:jb:3-09-81(#0641N)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: March 6, 1981

SUBJECT: ARCO/SOHIO Prudhoe Bay
PSD IV Completeness

FROM: Robert G. Courson, Chief
Technical Support Branch

TO: Michael M. Johnston, Chief
New Source Permits Section

We have reviewed the subject PSD application for completeness. Attached is a list of requests for additional information related to the ambient air quality analysis. The application may be considered complete with respect to the BACT analysis.

Attachment

ATTACHMENT

1. Section 6.2.2 - What were the hourly meteorological conditions associated with the maximum short-term SO_2 impacts?

2. Section 6.3.1 - What was the maximum NO_2 impact of proposed sources alone? We would appreciate a map of the Prudhoe Bay area showing the spatial distribution of predicted annual NO_2 concentrations due to all sources.

3. Section 6.3.2 - What were the hourly meteorological conditions associated with the maximum short-term TSP impacts?

4. Appendix C, p. C-5 - The modification for surface roughness of Sigma Theta (standard deviation of horizontal wind direction fluctuations) was applied incorrectly. The adjustment factor $(Z_o/15cm)^{0.2}$ should have been applied to the values in the stability classification table, rather than to the measured values. This error resulted from an inaccuracy in proposed EPA guidance (Proposed Revisions to Guideline on Air Quality Models, October 1980). We request that either 1) the error be corrected, the meteorological data be re-analyzed, and the modeling estimates be re-calculated, or 2) a demonstration be made that the error causes the concentration estimates to be conservatively high or changed by an insignificant amount.

FEB 12 1981

PSD Permit Application - ARCO/SOHIO (PSD IV)

Michael M. Johnston, Chief
New Source Permits Section (M/S 521)

Robert G. Courson, Chief
Technical Support Branch (M/S 329)

On February 9, 1981, we received an application (PSD IV) from ARCO/SOHIO for a PSD permit to install additional gas-fired turbines and heaters at the Prudhoe Bay, Alaska site.

Please review the application for completeness. In addition, determine for which pollutants BACT is necessary and for those pollutants requiring BACT, determine if the proposal employs the necessary technology. Also, please evaluate the air quality impact analysis and determine if there will be any violations of increments or standards. Identify any problems with a policy nature as early as possible so their resolution will not unnecessarily delay the review process.

In order to expedite this request, please feel free to contact the Company directly for any information you need. You may also want to schedule a meeting between key Company personnel and EPA staff. Any correspondence between EPA and the Company should be routed through me for the purpose of keeping our records straight.

We are required to respond to PSD applications within 30 days of receipt with a determination as to the completeness of that application. In this regard, please reply at your earliest convenience, but not later than March 11, 1981.

Attachment

cc: Paul Boys, w/o attach
Mike Trutna, w/attach
Rich Biondi, w/o attach
Stan Hungerford, w/o attach

DWILSON:jb:2-12-81(#0585N)

February 5, 1981

Regional Administrator
Region X
U. S. Environmental Protection Agency
1200 Sixth Avenue
Seattle, Washington 98101

Attention: Mr. Michael Johnston

Subject: SUBMITTAL OF A PREVENTION OF SIGNIFICANT DETERIORATION (PSD) PERMIT APPLICATION FOR NEW SOURCES TO BE ADDED TO EXISTING AND PREVIOUSLY PERMITTED FACILITIES IN THE PRUDHOE BAY UNIT

Dear Sir:

We hereby submit for your review and approval a Prevention of Significant Deterioration (PSD) permit application for proposed facilities to be constructed in the Prudhoe Bay Oil Field. Sohio Alaska Petroleum Company (Sohio) and ARCO Alaska Inc. (ARCO), as operators of the oil field, jointly submit this application on behalf of the Prudhoe Bay Unit Working Interest Owners.

The proposed facilities described in this application supplement those facilities described in the previously approved Produced Water Injection/Low Pressure Separation/Artificial Lift and Waterflood PSD applications. Atmospheric emissions from the proposed additional facilities will be produced by gas fired turbines and heaters with approximate total rated capacities of 303 MHP and 250 MM BTU/hour, respectively.

We have been informed that Northwest Alaskan Pipeline Company will submit a PSD permit application for their proposed Alaska Gas Conditioning Facility (AGCF) in early February 1981. The AGCF facilities are not a part of the Prudhoe Bay Unit facilities and therefore should be treated as separate entities in the permit review process. However, to facilitate the completeness determination for the Prudhoe Bay Unit application, the AGCF sources have been included in the impact analysis. The latest available source data as of January 16, 1981 was used for the proposed AGCF.

Financial commitment for some facilities outlined in this PSD application will occur during the fourth quarter, 1981. To meet these commitments and maintain current project schedules will require an approval of our request by September 1, 1981. If you so desire, we would be pleased to discuss this application in further detail at your convenience.

Very truly yours,

G. N. Nelson
Sohio Alaska Petroleum Company

P. B. Norgaard
ARCO Alaska Inc.

Attachment
cc: Mr. Tom Hanna, ADEC - Juneau
Mr. Doug Lowery, ADEC - Fairbanks
Mr. Jim Sweeney, USEPA - Anchorage